UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONS

MEMORANDUM

SUBJECT: Hazardous Waste Tank Systems Inspection Manual

FROM: J. Winston Porter
Assistant Administrator

TO: Regional Waste Management Division Directors
Environmental Services Division Directors
Regions I-X

Attached is a copy of the Hazardous Waste Tank Systems Inspection Manual developed by the RCRA Enforcement Division of OWPE. The manual was written as guidance to RCRA inspectors for inspections of hazardous waste treatment and storage tank systems pursuant to 51 FR 25422, July 14, 1986. Support for the development of the manual was provided by RCRA personnel from the Regions, States, and Headquarters. Additionally, the manual was reviewed by the Office of Solid Waste, the Office of Enforcement and Compliance Monitoring, and the Office of General Counsel.

The manual provides an explanation of the applicability of the tank system regulations in addition to:

- a complete regulatory overview; and
- detailed inspection procedures and inspection checklists

This manual complements the March 1988 RCRA Inspection Manual (OSWER 9938.2A) and expands on the inspection procedures contained therein.

If you have any questions concerning the manual, please contact Tim Kasten or Ken Gigliello, RCRA Enforcement Division, FTS 475-9320.

Attachment

cc: Regional Counsels
Hazardous Waste Branch Chiefs
RCRA Enforcement Section Chiefs
Regions I-X

Hazardous Waste Tank Systems Inspection Manual

RCRA Enforcement Division

Office of Waste Programs Enforcement

September 1988

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1.0 INTRODUCTION

1.1 Background

On July 14, 1986, EPA published the final rule governing hazardous waste storage and treatment tank systems. The rule went into effect on January 12, 1987. These regulations establish standards applicable to both new and existing tank systems, and include requirements for onground, inground, aboveground, and underground tank systems. These standards are applicable to permitted, interim status, and accumulation tank systems. An interim status requirement for small quantity generators is also part of this rule.

Section 3004(w) of the Hazardous and Solid Waste Amendments of 1984 (HSWA) required EPA to promulgate final permitting standards for hazardous waste underground storage tanks that cannot be entered for inspection. Section 3001(d) mandated promulgation of standards applicable to tank systems owned and operated by small quantity generators and section 3004(o)(4) stipulated that EPA must promulgate standards requiring any new underground tank system to incorporate an "approved leak detection system". Thus, permitting standards for underground storage tanks that cannot be entered for inspection, interim status requirements for small quantity generators and leak detection requirements for all new underground tank systems were promulgated pursuant to HSWA.

All other sections of the July 14, 1986 rule applying to aboveground, inground, onground, and underground tanks that can be entered, were promulgated pursuant to pre-HSWA (or RCRA) authority. **This dual HSWA-RCRA authority within one rule makes the determination of applicability difficult. All inspectors should carefully read Section 2.2 Applicability of the Hazardous Waste Tank System Regulations, before conducting tank system inspections.**

The purpose of these regulations is to protect human health and the environment by preventing releases of hazardous materials from storage and treatment tanks to soils, ground water and/or surface water. EPA's approach to obtaining this goal through these regulations is by:

- maintaining the integrity of the primary containment system
- monitoring to detect leaks from the primary containment system

- o requiring secondary containment for all new tank systems and phasing in secondary containment for all existing tank systems.

Proper response to releases of hazardous wastes from tank systems, careful operation, and frequent inspections are central to the final rule and will be reflected in this inspection guidance document.

1.2 Structure and Use of the Hazardous Waste Tank Systems Inspection Manual

The purpose of this guidance manual and the accompanying checklists is to provide guidance to inspectors so that they can assess compliance with the requirements of the July 14, 1986 rule. Inspection is the principal means available to EPA for enforcing the hazardous waste tank regulations. Authority to conduct inspections is explained in section 3007 of the Resource Conservation and Recovery Act or applicable state authority. [Inspection authority is discussed in more detail in the RCRA Inspection Manual (see No. 7 in appendix D).]

This manual contains an overview of the hazardous waste tank system regulations and a summary of EPA's enforcement approach. Three sections on conducting inspections are included:

- o inspection preparation,
- o the on-site inspection (which includes sections on inspecting facility records and conducting visual tank inspections), and
- o post-inspection review

The on-site inspection section is designed to go hand-in-hand with the compliance checklists provided in Appendix A. Based upon the inspection preparation review, the inspectors will select checklists that are applicable to the facility under review. Checklists corresponding to the general facility and to each tank type located at the facility will be selected by the inspector prior to the site visit. The evaluation section of the guidance document will provide the information necessary to assess the compliance of the facility to the general requirements of the rule (e.g. inspection logs) and the compliance of individual tank systems to specific standards (e.g. documented correct installation of a new tank system). More detailed technical information applicable to the assessment of compliance of a specific tank type, (e.g. concrete on-ground tank containing 50,000 gallons of liquid, sulfate bearing hazardous waste) is

provided as a separate reference section in Appendix B. This appendix will be used to supplement the evaluation section.

Additional appendices include a glossary and a reference section. This document can also be used as a general reference to the hazardous waste storage and treatment tank rule along with the other documents listed below. This manual can also be used as a training tool.

1.3 Relationship of this Document to Other Guidance Manuals

The Hazardous Waste Tank Inspection Guidance is specific to the tank rules and is designed to be supplemented with other guidance documents. EPA has developed the RCRA Inspection Manual (see appendix D, No. 7), which provides overall guidance for RCRA inspections, including information on administrative procedures, entry, and a general approach for conducting inspections. The Hazardous Waste Tank Systems Inspection Manual is designed to complement the RCRA Inspection Manual.

Additional guidance documents that may be useful in providing more detailed information on hazardous waste tank systems or on specific areas of the hazardous waste tank rule are:

- RCRA Technical Case Development Guidance Document, OSWER 9938.3, June 1988.
- Technical Resource Document for Obtaining Variances from the Secondary Containment Requirement for Hazardous Waste Tank Systems, Vol. I and II, OSWER Policy Directive No. 9483.00-2 (EPA/530-SW-87-002A & 002B).
- Technical Resource Document: The Storage and Treatment of Hazardous Waste in Tank Systems, OSWER Policy Directive No. 9483-00-12 (EPA/530-SW-86-044).

A brief description of these and other helpful references is provided in Appendix D.

2.0 OVERVIEW OF HAZARDOUS WASTE TANK SYSTEM REGULATIONS

2.1 The Regulatory Approach/Framework

The July 1986 rule is designed to protect human health and the environment by preventing releases of hazardous wastes from tanks and by rapidly detecting and addressing accidental releases that do occur.

The rule outlines design and operating requirements for new and existing permitted tank systems, small quantity generators, and 90-day accumulation tanks including requirements for the following:

- o sound primary containment
- o secondary containment
- o adequate detection and monitoring technology
- o detailed recordkeeping
- o daily inspections
- o independent evaluations of tank integrity and tank installation

The following regulatory overview is to provide the inspector with a brief summary of the existing hazardous waste regulations. It is not meant to, and should not, preclude the inspector from reading and becoming familiar with the complete rule. If something in this guidance does not answer a specific question, the inspector should check the original rule or call the RCRA hotline (1-800-424-9346).

2.2 Applicability of the Hazardous Waste Tank System Regulations

The regulations apply to owners and operators of facilities that use:

- o aboveground,
- o onground,
- o inground, and
- o underground

tank systems used for storing or treating any hazardous wastes.

All sections of the rule applicable to aboveground, onground, inground, and underground tanks that can be entered for inspection, are promulgated pursuant to RCRA (Pre-HSWA) authorities. Tank systems in these categories, which are located in unauthorized states, must meet all federal requirements. Tank systems in these categories in authorized

states are not required to comply with the July 14th Rule until such time as the authorized state amends its statute.

These regulations **do not** apply to underground tanks storing petroleum or hazardous substances listed under Superfund (other than hazardous waste). Tanks that store petroleum and hazardous substances (other than hazardous waste) must comply with Subtitle I of RCRA (Underground Storage Tank Program) and are likewise not regulated under 40 CFR Subpart J (Hazardous Waste Tank Systems). The hazardous waste tank system regulations should not be confused with the Underground Storage Tank Program (UST).

The requirements for leak detection for all new underground tank systems, the technical and permitting standards for underground tank systems that cannot be entered for inspection and the interim status requirements applicable to small quantity generators operating tank systems are promulgated under HSWA and are effective in all states, regardless of authorization status.

2.2.1 Existing Tank Systems

Existing tank systems are defined as:

- o tank systems already in operation on July 14, 1986
- o tank systems for which installation commenced prior to July 14, 1986

The definition of existing tank systems under this rule is different from the definition of existing and new facilities for the purposes of determining eligibility for interim status.

The regulations require that:

- o secondary containment and interstitial monitoring be phased in for existing tanks according to the following schedule:
  - for existing tanks storing or treating listed dioxin-containing wastes, by January 12, 1989
  - for existing tank systems of known and documented age, by January 12, 1989 or when the tank system has reached 15 years of age, whichever comes later
  - for existing tank systems for which the age cannot be documented, by January 12, 1995; but if the age of the facility is greater than seven years, by the time the facility reaches 15 years of age or by January 12, 1989 whichever comes later

- any component of a tank system that cannot be visually inspected and has been found to be leaking, must be provided with secondary containment prior to being returned to service

Existing interim status or permitted tank systems that have not implemented secondary containment:

- o must obtain and keep on file at the facility a written assessment of the tank system's integrity reviewed and certified by an independent, qualified, registered engineer.

The owner/operator of permitted tanks must comply with permit conditions. Therefore, a permitted facility with hazardous waste storage or treatment tanks may have to obtain a permit modification if their permit does not incorporate the July 14, 1986 regulations [§270.4(a)].

2.2.2 New Tank Systems

A new tank system is defined as:

- o a system or component that will be used to store or treat hazardous waste or for which installation has commenced after July 14, 1986
  - this includes tank systems that are already manufactured before July 14, 1986, but put into service after July 14, 1986
  - this includes existing tank systems that have not been used for the storage or treatment of hazardous waste but are then put into service or converted to use as hazardous waste storage or treatment tank systems subsequent to July 14, 1986
  - this includes tank systems previously used for storing or treating hazardous waste that were taken out of service before July 14, 1986, but put back into service after July 14, 1986

The regulations require that:

- o secondary containment and leak detection capability must be provided for all new hazardous waste tank systems

- o the owner/operator must submit, with the Part B application, a written assessment, reviewed and certified by an independent, qualified, registered professional engineer attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste

- o the installation of a new tank system must be directly supervised by an independent, qualified installation inspector or an independent, qualified, registered, professional engineer and that the same inspector or engineer must carefully inspect the system prior to covering, enclosing or placing the new tank system or component in use

- o all new tanks and ancillary equipment must be tested by an independent, qualified, registered, professional engineer for tightness prior to being covered, enclosed, or placed in use

2.2.3 Less Than 90-Day Accumulation Tank Systems

-- Effective for all 90-day accumulation tank systems in unauthorized states and in all states for 90-day accumulation tank systems that are new underground tanks or underground tanks that cannot be entered by inspection --

Generators may accumulate hazardous waste in tanks on-site for 90 days or less without a permit or without interim status provided:

- o the generator complies with Part 265 Subpart J (tanks) [this includes compliance with secondary containment requirements] except for §265.197(c) (closure and post-closure requirements for tanks) and § 265.200 (waste analysis and trial tests)

- o the generator complies with Part 265 Subparts C (Preparedness and Prevention) and D (Contingency Plan and Emergency Procedures)

- o the generator complies with other applicable requirements of §262.34.

Generators accumulating hazardous waste on site for 90 days or less are exempt from Part 265 Subparts G (general closure and post-closure requirements) and H (financial responsibility), except for §265.111 (closure performance standard) and §265.114 (disposal or decontamination of equipment, structures and soils).

A generator who accumulates waste for more than 90 days is subject to the requirements of 40 CFR, Parts 260-266 and Part 270. The Regional Administrator has the authority to grant an extension of 30 days [§262.34(b)] to the 90-day limit.

2.2.4 Small Quantity Generators

-- Effective in all states --

Facilities generating between 100 and 1,000 kg/mo of hazardous waste that accumulate the waste in tanks may operate tanks without a permit provided:

- o the generator accumulates waste in the tank systems for less than 180 days (or 270 days if the generator ships the waste greater than 200 miles)

- o the generator does not accumulate over 6000 kg of waste on-site at one time

- o the generator complies with other applicable requirements of §265.201.

Generators of between 100 and 1000 kg/month of hazardous waste, which accumulate waste for less than 180 days (or 270 days if waste is shipped over 200 miles) and do not accumulate more than 6000 kg at one time, must comply with §262.34(d).

Generators who accumulate hazardous waste in tanks on-site for more than 180 days (or 270 days), or who accumulate more than 6000 kg at one time, are subject to 40 CFR, Parts 260-266 and Part 270.

2.2.5 Exemptions

The following tank systems are exempt from the July 14, 1987 rule:

- tank systems which are a part of a closed-loop system that store secondary materials intended to be reclaimed
- treatment tanks discharging wastes through an outfall with an NPDES permit
- tank systems operated by generators generating 100 kg/month or less hazardous waste (unless waste is acute hazardous waste).

The containment and detection requirements (§264.193 and §265.193) do not apply to:

- tanks that are used to store or treat hazardous waste which contain no free liquids and are situated inside a building with an impermeable floor
- a tank that serves as part of a secondary containment system designed to collect or contain accidental releases of hazardous waste
- a sump, defined as any pit or reservoir that meets the definition of a tank and those troughs/trenches connected to it (see glossary in Appendix C), that serves as part of a secondary containment system designed to collect or contain accidental releases of hazardous wastes.

2.3 Variances

There are two types of variances from the secondary containment and detection requirements:

- technology-based variance
  - the owner/operator must demonstrate that alternative design and operating practices, together with location characteristics, will prevent the migration of any hazardous constituents into the ground water or surface water at least as effectively as secondary containment during the active life of the tank system
- risk-based variance
  - the owner/operator must demonstrate that in the event of a release that does migrate to ground water or surface water, no substantial present or potential hazard will be posed to human health or the environment

New underground tank systems are not allowed a risk-based variance.

Where interim status facilities are concerned, the Regional Administrator must notify the public, allow for a 30-day comment period, provide an opportunity for a hearing, and approve or disapprove the request in 90 days.

2.4 Summary of Regulation

The seven major issues addressed in the regulations are:

- Primary Containment/Tank Integrity Assessments
- Tank Installation
- Secondary Containment and Detection
- Response to Leaks/Spills
- Inspections/Operation and Maintenance
- Closure and Post-Closure
- Small Quantity Generators

2.4.1 Primary Containment/Tank Integrity Assessments

- o tanks must be constructed with materials compatible with the wastes stored or treated in them

- o for new and existing tanks a written assessment, reviewed and certified by an independent, qualified, registered, professional engineer, of the tank's structural integrity and adequacy for storing the wastes it is meant to store must be obtained and placed on file at the facility; for new tanks the assessment must be filed with the Part B permit application

2.4.2 Tank Installation

- o new tank owner/operators are responsible for the tank being properly installed

- o the installation of a new tank must be directly supervised by an independent, qualified, installation inspector or an independent, qualified, registered, professional engineer

- o before covering, enclosing, or placing a new tank system or component in use the independent, qualified installation inspector or the independent, qualified, registered professional engineer must inspect the system for a number of structural problems outlined in the regulations

- o all new tanks and ancillary equipment must be tested for tightness prior to being covered, enclosed or placed in use

2.4.3 Secondary Containment and Detection

All secondary containment systems must be:

- o designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, ground water, or surface water at any time during the use of the tank

- capable of detecting and collecting releases and accumulated liquids until the collected material is removed

- constructed of, or lined with, materials that are compatible with waste(s) to be placed in the tank system

- equipped with a means of release detection which is capable of detecting the failure of either the primary or secondary containment structure or the presence of any release in the secondary containment system within 24 hours or the earliest practicable time

- sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation

Secondary containment for tanks must include one or more of the following:

- a liner
- a vault
- a double-walled tank
- an equivalent device as approved by the Regional Administrator

2.4.3.1 Liners

External liners must be:

- designed to contain 100 percent of the capacity of the largest tank within its boundary

- designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless it contains sufficient capacity to contain precipitation from a 25-year, 24-hour rainfall event in addition to the capacity of the largest tank within the boundary of the secondary containment system

- free of cracks or gaps

- designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if released from the tank

2.4.3.2 Vault Systems

Vault Systems must be:

- designed to contain 100 percent of the capacity of the largest tank within its boundary
- designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration from a 25-year, 24-hour rainfall event in addition to the capacity of the largest tank within the boundary of the secondary containment system
- constructed with chemical-resistant water stops in place at all joints
- provided with an impermeable interior coating or lining that is compatible with the stored waste and will prevent the migration of waste into the concrete
- provided with the means to protect against the formation of and ignition of vapors within the vault, if the waste being stored or treated meets the definition of ignitable waste or reactive waste (§262.21)
- provided with an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure

2.4.3.3 Double-Walled Tanks

Double-walled tanks must be:

- designed as in integral structure so that any release from the inner tank is contained by the outer shell

- protected, if metal, from both corrosion of the primary tank interior and of the external surface of the outer shell

- provided with a built-in continuous leak detection system capable of detecting a release within 24 hours or the earliest practicable time

2.4.3.4 Ancillary Equipment

All ancillary equipment must be provided with secondary containment except for:

- aboveground piping (exclusive of flanges, valves, joints and other connections) that is visually inspected for leaks on a daily basis

- welded flanges, joints and connections that are visually inspected on a daily basis
  Note: this exception is currently under review by EPA. The inspector should look for updated information concerning this.

- sealless or magnetic coupling pumps that are visually inspected on a daily basis

- pressurized aboveground piping systems with automatic shut-off devices that are visually inspected on a daily basis

2.4.4 Inspections/Operation and Maintenance

The owner/operator must:

- use spill and overfill prevention controls

- maintain sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or precipitation

- develop a schedule and procedure for inspecting overfill controls

- inspect at least once every operating day aboveground portions of the tank system, data gathered from monitoring equipment, the area immediately surrounding the externally

accessible portions of the tank system, including the secondary containment system, to detect erosion or signs of releases of hazardous waste

- o confirm the proper operation of the cathodic protection system, if present, within six months of installation and annually thereafter
- o inspect or test all sources of impressed current at least bi-monthly
- o maintain detailed operation and maintenance records.

2.4.5 Response to Leaks/Spills

In the event of a leak or spill:

- o the owner/operator must remove the tank system from service immediately and must stop the flow of hazardous waste into the tank system or into the secondary containment system and determine the cause of the release
- o within 24 hours after detection the owner/operator must remove as much waste as necessary from the tank system to prevent further release to the environment
- o all hazardous materials released to the secondary containment must be removed within 24 hours or in as timely a manner as is possible to prevent harm to human health and the environment
- o any release to the environment must be reported to the Regional Administrator within 24 hours of detection unless the leak or spill of hazardous waste is less than or equal to a quantity of 1 pound and is immediately contained and cleaned up
- o within 30 days of detection of a release to the environment that is greater than one pound or of any quantity that is not immediately cleaned up, the owner/operator must submit a report to the Regional

Administrator discussing the likely route of migration of the release, characteristics of surrounding soil (geology), results of any monitoring or sampling and proximity to downgradient drinking water, surface water and population areas

- if a spill occurs that is not related to any damage to the integrity of the tank system, the system may be returned to service as soon as the owner/operator removes and properly disposes of the waste and the proper repairs are made

- if a leak occurs from primary containment to secondary containment the system must be repaired prior to returning the system to service

- if a release to the environment occurs from a component of a tank system without secondary containment the owner/operator must provide the component or components from which the leak originated with secondary containment before returning the system to service, unless the source of the leak is an aboveground portion of a tank system that can be inspected visually

- if a leak is discovered that is underground or if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection the entire component must be provided with secondary containment before the tank system is returned to service

- any major repairs must be certified by an independent, qualified, registered professional engineer before the system can be returned to service

In the event of a visible release to the environment the owner/operator must immediately conduct a visual inspection of the release and, based upon that inspection:

- prevent further migration of the leak or spill to soils or surface water; and

- o remove and properly dispose of any visible contamination of the soil or surface water

2.4.6 Closure and Post-Closure Care

- o the owner/operator must remove or decontaminate all waste residues, contaminated containment system components, contaminated soils, and structures and equipment contaminated with waste and manage them as hazardous waste

- o if the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated then the owner/operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (§264.310)

- o if an owner/operator has a tank system that does not have secondary containment that meets the requirements of §264.193 and has not obtained a variance then:

  - the closure plan for the tank system must include both plan for removing or decontaminating all waste residues and tank equipment and managing them as hazardous waste as well as a contingency plan for closing the tank system and performing post-closure care requirements under the same requirements as for landfills

  - a contingent post-closure plan must be submitted with the permit application

  - the estimated costs for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if those costs are greater than the costs for closing the tank system as a tank system and not a landfill

- financial assurance must be based on the highest estimated costs

- for the purposes of the contingent closure and post-closure plans, such a tank system is considered to be a landfill and the contingent plans must meet all of the closure, post-closure, and financial requirements for landfills under Subparts G and H.

2.4.7 Small Quantity Generators

Generators of between 100 and 1000 kg/month hazardous waste must comply with the following general operating requirements:

- o treatment or storage of hazardous waste in tank systems must comply with §265.17(b) [general requirements for ignitable, reactive, or incompatible wastes]

- o hazardous wastes or treatment reagents must not be placed in a tank if they could cause the tank or its inner liner to rupture, leak, corrode, or otherwise fail before the end of its intended life

- o uncovered tank systems must be operated to ensure that at least 60 cm (2 feet) of freeboard is maintained unless the tank system is equipped with a containment structure, a drainage control system, or a diversion structure with a capacity that equals or exceeds the volume of the top 2 feet of the tanks

- o where hazardous waste is continuously fed into a tank system, the tank system must be equipped with a means to stop this inflow

Generators of between 100 and 1000 kg/month hazardous waste that are accumulating wastes in tanks must inspect, where present:

- o discharge control equipment at least once each operating day

- o data gathered from monitoring equipment atleast once each operating day to ensure that it is in good working order

- o the level of waste in the tank at least once each operating day

- o the construction materials of the tank at least weekly to detect corrosion or leaking of fixtures or seams

- o the construction materials of, and the area immediately surrounding, discharge confinement structures at least weekly to detect erosion or obvious signs of leakage, and

- o the owner/operator must remedy any deterioration or malfunction found.

Generators of between 100 and 1000 kg/month hazardous waste that are accumulating wastes in tanks must, upon closure of the facility, remove all hazardous waste from the tank system, discharge control equipment, and discharge confinement structures and must manage any hazardous wastes in accordance with all applicable requirements of Parts 262 (standards applicable to generators), 263 (standards applicable to transporters) and 265 (interim status standards for owners and operators of TSD facilities).

Small quantity generators that generate more than one kg/month of acute hazardous waste, or more than 100 kg/month of any residue or contaminated soil, waste, or other debris resulting from the spill or cleanup of acute hazardous waste, are subject to 40 CFR, Parts 262-266 and Part 270.

2.4.8 Special Wastes

An owner/operator storing or treating hazardous waste in a tank system (including small quantity generators and those operating 90-day accumulation tank systems) must comply with the following special requirements for ignitable and reactive wastes:

- o ignitable or reactive waste must not be placed in a tank unless:

- the waste is treated, rendered or mixed before or immediately after placement in a tank so that the resulting waste, mixture or dissolution of material no longer meets the definition of ignitable or reactive waste and the owner/operator takes precautions to prevent reactions which may be hazardous to human health or the environment [§265.17(b)] or

- the waste is stored or treated in such a way that it is protected from any material or conditions that may cause the waste to ignite or react or

- the tank system is used solely for emergencies

- the owner/operator of a facility which treats or stores ignitable or reactive waste in covered tanks must comply with the buffer zone requirements for tanks contained in Tables 2-1 through 2-6 of the National Fire Protection Association's Flammable and Combustible Liquids Code (1977 or 1981)

An owner/operator storing or treating hazardous waste in a tank system must comply with the following special requirements for incompatible wastes:

o incompatible wastes or incompatible wastes and materials must not be placed in the same tank unless the owner/operator takes precautions to prevent reactions which may be hazardous to human health and the environment [§265.17(b)]

o hazardous waste must not be placed in an unwashed tank which previously held an incompatible waste or material unless the owner/operator takes precautions to prevent reactions which may be hazardous to human health and the environment [§265.17(b)]

3.0 ENFORCEMENT APPROACH

As stated in Section 1.0, the goal of the hazardous waste tank systems regulations is to prevent the release of hazardous wastes to the environment from tank systems. Therefore, inspectors should focus on:

1. The phasing in of secondary containment for existing tank systems

   - inspectors should ensure that secondary containment is provided when required **(see Figure 3)**

2. Documentation of the proper installation and integrity assessment for new tank systems

   - inspectors should review documentation to verify that each tank system has been installed properly

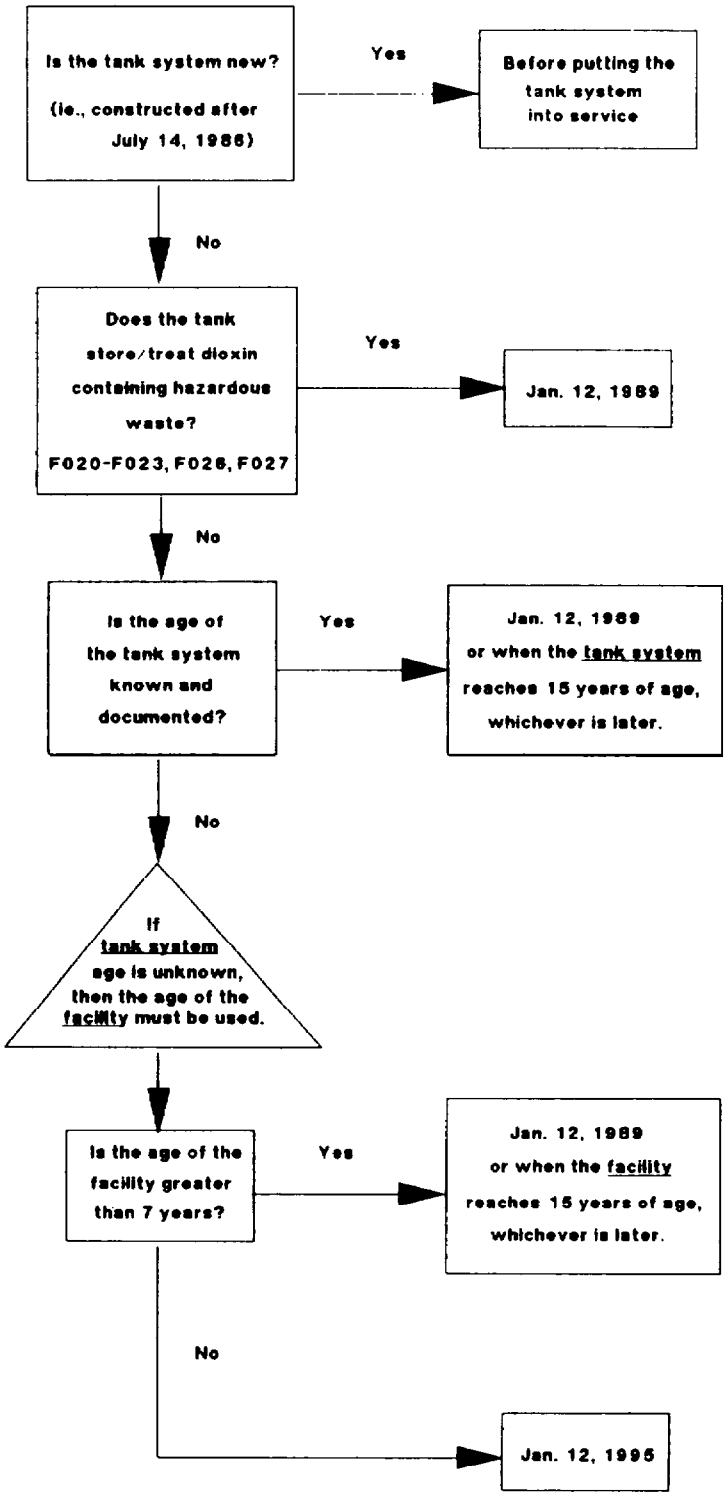
3. Violations of inspection requirements

   - because the documentation of the tank system inspection requirements is central to the goal of identifying and stopping releases, a violation of those same recordkeeping requirements can be a serious impediment to the goals of this program

4. Implementation of spill and overfill prevention and control measures

   - inspectors should carefully inspect tank systems to ensure that the proper spill and overfill prevention controls are in place and working

Figure 3
*Deadlines for Secondary Containment of Tank Systems



*** Deadlines may vary depending on state authorization. Review Chapter 2.2 (Applicability) of this manual.**

4.0 PREPARING FOR THE INSPECTION

Prior to conducting an inspection of a facility operating hazardous waste tank systems, the inspector will want to answer a number of questions to determine how the July 14, 1986 rule applies to the individual facility in question. Figure 4A is a flow chart showing applicability of the July 14 rule. After charting a tank system through Figure 4A, the inspector should follow through with Figure 3 to determine the secondary containment deadlines for each regulated tank system.

The following documents, which can be obtained from the states or regions prior to the inspection, may be used as information sources to determine applicability of the rule:

- Permit applications: Part A and Part B
- Permits
- Notification forms: EPA Notification of Hazardous Waste Activity
- For new tank systems, a written assessment of tank integrity (Part B)
- EPA or state inspection reports
- Report to the regional administrator of any spills/leaks
- Any other correspondence to the states or regions
- Record of a granted variance

Based on the information gathered during inspection preparation, the inspector should assemble the necessary checklists to take on-site. The checklists will form the basis of the on-site inspection and post-inspection review. There are eight checklists, some of which will or will not be used depending on the type of facility (e.g., small quantity generator) or type of tank (e.g., existing or new tank system) being inspected. Figure 4B illustrates the relationship between the different checklists and how they are to be used during an inspection.

The regulatory provisions for permitted and interim status tank systems are essentially parallel, so there are no distinctions made between permitted and unpermitted tank systems in the checklists. However, permits need to be reviewed before inspecting a permitted tank system so that compliance with permit-specific requirements can be checked. In addition, because 90-day accumulation tank systems are only exempt from financial and closure requirements and are still subject to provisions requiring secondary containment, Checklists III and IV (Existing and New Tanks) should be used for 90-day accumulation tanks.

Figure 4A.
Applicability of the July 14, 1986 Hazardous Waste Tank Regulations

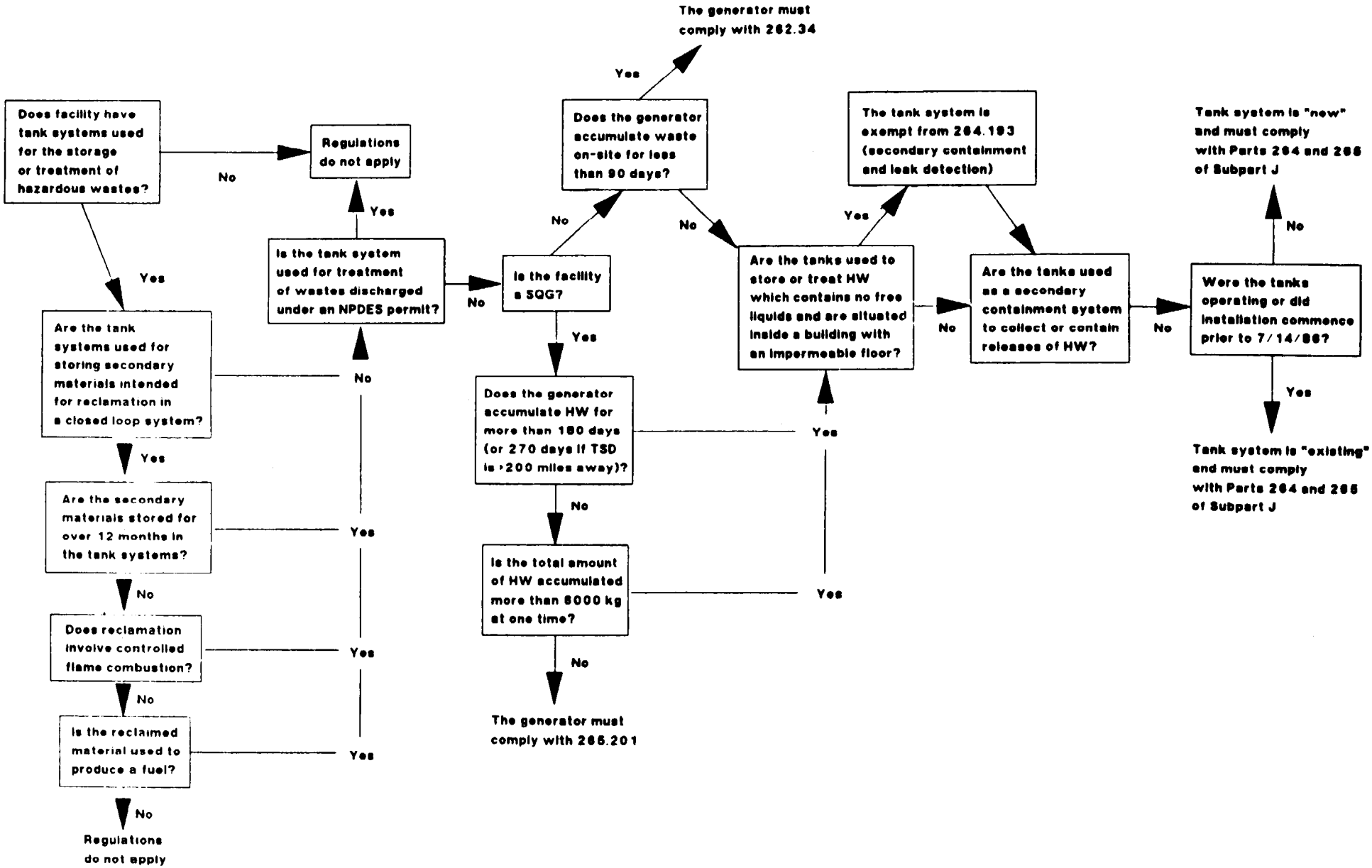
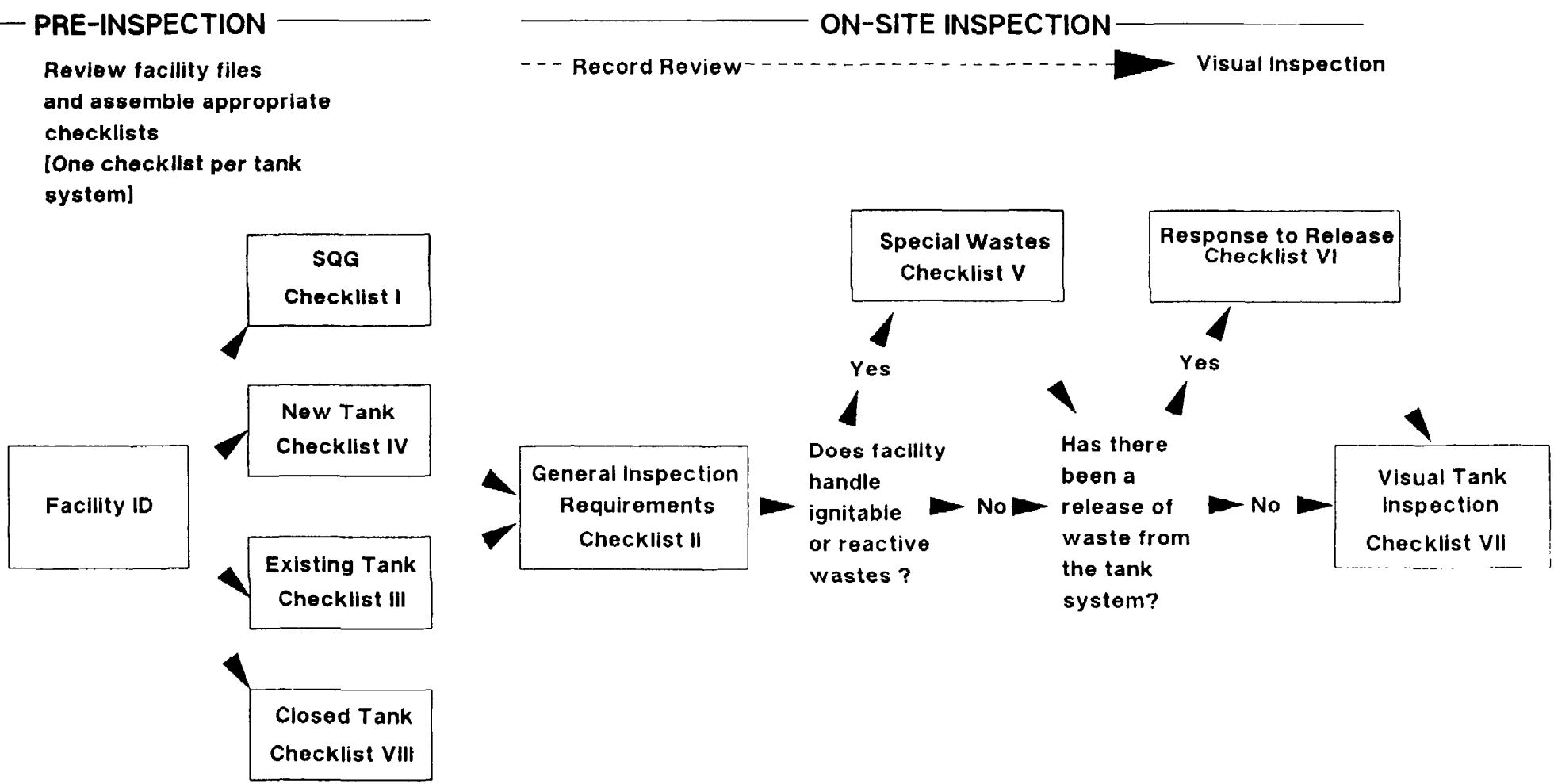


FIGURE 4B

How to Use Checklists in Appendix A



5.0 ON-SITE INSPECTION PROCEDURES

This chapter is intended to walk the inspector through an on-site inspection. For the convenience of the inspector, the chapter is organized by checklist with each section providing the explanations and additional references for checklist items that may not be self-explanatory. The inspector should review Chapter 4.4 of the RCRA Inspection Manual (March 1988) on the use of inspection checklists. **Note:** Questions included in the checklists that do not directly pertain to requirements of this rule, but are used to "flag" or alert the inspector to conditions that may lead to future violations, are marked with an asterisk.

One facility identification form will be filled out per facility. This form is simply a way of summarizing the vital statistics of the facility being inspected.

Generally, the inspector should plan to start the inspection with a record review. After examining facility records, the inspector will conduct a visual inspection of the tank system(s).

5.1 Small Quantity Generators [Checklist I]

Generators of between 100 and 1000 kg/month hazardous waste are treated as a subset of the hazardous waste tank universe. Inspections of these facilities will not include checklists II, III, IV, VII, and VIII. Because only one checklist will be used, some universal tank questions which may not appear on other checklists appear on the SQG checklist (I). Since many SQG's have only tanks, this might very well be the only inspection by EPA at a facility. Therefore, general compliance questions are included here whereas the other lists only cover the July 1986 hazardous waste tank regulation.

A.1* The inspector should have the owner/operator provide the volume of the tank. During the visual inspection the inspector should verify that the tank size is appropriate for the volume that it is stated to hold (e.g., a 100 gallon tank would not be a cylindrical tank of 4.5 feet diameter and a height of 8 feet. That size tank would be closer to a 1000 gallon tank). §265.201(a) stipulates that those SQG's which accumulate over 6 000 kg of hazardous waste at one time must obtain a permit and comply with 40 CFR, Parts 264, 265 and 270. The inspector should be aware that aqueous wastes exceed the 6,000 kg cutoff at 1,585 gallons. If you suspect that a generator keeps more than 6,C00 kg on-site before shipment, you can

calculate the approximate weight based upon the size of the tank system and the general density of the waste type.

A.2 The inspector should provide a general description of the tank type in the following areas:

(a) in-, above-, on-, underground
(b) steel, stainless steel, FRP, concrete, other
(c) lined, unlined, open-topped

B.1 The inspector should try to obtain as specific a waste analysis as possible.

B.2 A small quantity generator will probably not have a permit so the inspector should find out from the owner/operator what wastes have been stored in the tank. Verify the information using hazardous waste manifests. This is to provide information on any potential mixing of incompatible wastes. If the tank holds more than one waste type, the inspector can refer to waste incompatibility tables (Appendix B, 9a-f) to note potential problems.

The inspector should check if the generator is generating acute hazardous waste. A list of acute hazardous wastes can be found in Appendix B-25, a-d. If a generator is generating more than one kg/month of acute hazardous waste or more than 100 kg/month of any residue or contaminated soil, waste, or other debris resulting from the cleanup of a spill of acute hazardous waste, the generator is subject to Parts 262-266 and Part 270. If the owner/operator is storing/treating acute hazardous waste in a tank system, the inspector should refer to 40 CFR §261.5(e) and turn to the appropriate checklists (i.e., new or existing tanks, etc.).

B.3 The inspector should indicate whether the waste and the tank material are compatible by using Appendix B, 4a-e.

C.1 The inspector should examine the manifest file to determine whether or not the generator is storing waste on-site beyond the number of days allowed.

C.2-C.4
If the generator ships waste 200 miles or less, waste can be accumulated for 180 days [§265.201(a)]. If waste is shipped more than 200 miles, it can be

accumulated in tanks up to 270 days. If the number of days allowed for accumulating waste in tanks has been exceeded, the generator must comply with 40 CFR, Parts 264, 265, and 270.

C.5 The owner/operator must inspect the tank system according to the criteria of §265.201(c), however, they are not required to maintain documentation. It is important for the inspector to phrase these questions so that the owner/operator provides information on the frequency and type of inspections. For example, "Please describe your tank inspection procedures and frequency".

D. Requirements for SQG's that handle special wastes are the same as for other facilities. If a SQG facility handles ignitable or reactive wastes, refer to Checklist V.

E. This part of the checklist refers to the visual inspection of the SQG.

E.1 As long as SQG's accumulate hazardous waste on-site they are required to clearly label tanks with the words "hazardous waste" [§262.34(a)(3)]. The inspector should verify this during the visual inspection.

E.2 The presence of any of these conditions indicates corrosion of the tank system [§265.201(b)(2)].

E.3 The inspector should be careful to note if there have been any apparent leaks or spills.

E.4 SQG tank systems must comply with §265.201(b)(3), which requires 2 feet of freeboard on open tanks

E.5 SQG's must comply with §265.201(b)(4), which requires that tank systems be equipped with a means to stop inflow where waste is continuously fed into the tank system

F. This section covers the general requirements under 40 CFR, Part 262 for SQG's. Because these facilities do not undergo routine facility inspections, verification of adequate emergency response measures are important.

5.2 Recordkeeping and Inspection Logs

The regulations require that owner/operators of hazardous waste treatment and storage tank systems (that are not otherwise exempt) and generators operating 90-day accumulation tank systems maintain detailed records documenting the age and integrity of the tank system as well as the operation and maintenance of the system. The recordkeeping requirements are an integral part of the regulatory strategy because:

- the recordkeeping procedures force the owner/operator to test the integrity of tank systems and to inspect and properly maintain tank systems so as to prevent leaks
- the records themselves may provide the information needed by inspectors to determine if there are violations at the facility.

Because the recordkeeping requirements are designed to aid in enforcement of the regulation, a violation of those same requirements should be documented and some enforcement action should be taken in response.

The records that the inspector should examine while on-site are outlined below.

5.2.1 New and Existing Tanks

[Checklist II: Documentation of General Inspection Requirements]

This checklist includes 90-day accumulation tanks.

A.1 The inspector should determine if the owner/operator has an adequate inspection procedure. The inspector can request to see a written plan/procedure for conducting the required inspections. If not available, the inspector should ask the owner/operator for a verbal description of daily inspection procedures.

The inspector may also want to review Chapter 10 of the OSWER Policy Directive (see appendix D, No. 11), or Section 5.3.1 of this chapter (Visual Inspection of Tank System) for the appropriate steps owner/operators should take to conduct tank inspections.

A.2 If the tank is permitted, the owner/operator should have a schedule and procedure for inspecting overfill controls [§264.195(a)]. If the tank is unpermitted

(interim status) the owner/operator must inspect overfill controls each operating day [§265.195(a)(1)].

The inspector should ask the owner/operator to see the schedule and procedure to determine if the procedures are adequately documented and, if so, to determine if the schedule/procedure is appropriate (e.g., it is not acceptable if the owner/operator inspects overfill controls monthly).

A.2a The inspector should then examine logbooks where results of inspections by facility personnel are kept and note if the inspections of overfill controls are taking place as scheduled, if the inspection procedures are followed and if clear and concise notes are taken.

A.3 The inspector should review the logbooks to verify that all aboveground portions of the tank system have been inspected daily [§264.194(a)(1)].

A.3a Various inspection tools may be used by the owner/operator in conducting daily inspections of the aboveground portions of tanks. These devices may include scrapers or hammers used to locate corroded areas. A more detailed description of inspection tools and how to use them is provided in the OSWER Policy Directive (see appendix D, No.11) Chapter 10. This question is included to flag a facility that may not have inspection procedures adequate to identify unfit tank system components.

A.4 The type of tank and/or leak-detection equipment employed at the facility will determine how the owner/operator monitors for leaks. The leak-detection device may print out a reading, or the owner/operator may have to read and record data from an instrument or from a visual inspection. The inspector should examine printouts or logbooks to ensure that the data from leak detection devices is recorded each operating day and that equipment is working.

The inspector should examine logbooks to ensure that the owner/operator is recording data from all temperature and pressure gauges and from any other monitoring devices.

(The inspector may want to choose a period of time (e.g., one month) randomly to examine the owner/operators logbook to determine if daily

inspection procedures are being followed properly).

A.5 The owner/operator is required to inspect both the construction materials of the tank system and secondary containment each operating day. The inspector should determine either from the owner/operator or from a written plan that the daily inspection includes: signs of releases or corrosion around nozzles and ancillary equipment of the tank system; signs of corrosion on tank tops or roofs; defective manhead gaskets; corrosion or releases, cracks, and buckles on seams and plates of the tank wall and bottom; possible erosion around the foundation, pads, and secondary containment, if any, and; deterioration of protective coatings as indicated by corrosion, blisters, discoloration, or film lifting. [§264.194(b)(3)].

A.6 The owner/operator must confirm the proper operation of the cathodic protection system within six months after the initial installation. The owner/operator is required to have a record of the confirmation on file at the facility [§264.194(c)(1)]. The owner/operator should also provide dates as to the installation of the cathodic protection system on an existing tank system if it is different from the tank installation date.

Confirmation of the proper operation of the cathodic protection system should be conducted by a corrosion expert. A tank structure-to-soil potential measurement should be conducted to ensure a minimum level of -0.85 volts. The owner/operator's logbook should contain a detailed description of the method used to determine proper operation and the results of the method used.

A.6a The owner/operator is required to conduct an annual inspection of cathodic protection [§264.194(c)(1)]. The logbook or records at the facility should indicate that a corrosion expert conducted tank structure-to-soil potential measurements and that the minimum level was -0.85.

A.7 The owner/operator is required to inspect any impressed-current system bimonthly. The owner/operator should inspect the timing device that controls the rectifier to make sure that there has been continuous output from the impressed-current system. The inspector should also check for electrical shorts, ground connection, circuit

resistance, and meter accuracy and efficiency. More information on impressed-current systems is provided in the OSWER Policy Directive (see appendix D, No. 11).

A.7a*The inspector should determine and record how the owner/operator inspects the impressed-current system.

5.2.2 Existing Tanks [Checklist III, Existing Tank Systems]

Existing tank systems are those that are in operation on July 14, 1986 or for which installation had commenced prior to July 14, 1986. See the glossary, Appendix C, for the complete definition of an existing tank system (see also Figures 4A and 4B for applicability of regulations and use of the checklists).

A.1 The inspector should record the tank volume. For permitted tanks, the volume should correspond to the permit. For interim status tanks, this question provides information which the inspector might not be able to obtain elsewhere.

A.2 The inspector should record the tank type. Depending on whether the tank system is underground or above-, on- or inground. In addition, depending on whether or not the state is authorized, some tank types (underground, non-enterable) may be required to be in compliance with the regulations before other tank types (see Section 2.2 on applicability of the regulation).

B.1 The inspector should determine the waste content of the tank by using documentation in the files (e.g., the written assessment of the tank's integrity or any manifests filled out if waste is shipped off-site for disposal). The EPA Hazardous Waste Numbers are provided in 40 CFR, §261.30-33, Subpart D.

If the wastes stored or treated in the tank are dioxin-containing wastes (F020, F021, F022, F023, F026, or F027) secondary containment, if not already installed, must be provided by January 12, 1989 [§264.193(a)(2)].

C.2 If the tank system has been granted a variance, then the system does not have to have secondary containment. The existence of an application for a variance does not mean anything in terms of the regulatory requirements; it is only when a variance is granted that there is an impact on the facility inspection.

C.3-C.4
By January 8, 1988 the owner/operator must have on file at the facility a written assessment attesting to the tank system's integrity [§264.191(a)]. The written assessment must be reviewed and certified by an independent, qualified, registered, professional engineer. The language necessary for certification is provided in Appendix B-1 and in 40 CFR 270.11(d).

Tank Age Documentation
(Review Figure 3)

C.5 The written assessment must document the age of the tank if the owner/operator has that information [§264.191(a)(4)]. The age of the tank is necessary to determine when secondary containment is required.

C.5a If the tank age is not documented (that is, if dated plans/contracts or other appropriate information identifying the tank are not provided by the owner/operator) then it is important to mark 'unknown'. Secondary containment is required by 1/12/89 or when the tank is 15 years old, whichever comes later [§264.193(a)(3)].

C.6 The age of the facility should be recorded to determine when secondary containment is required if the age of the tank is not documented [§264.193(a)(4)]. If the facility is seven years or less, the tank must be provided with secondary containment by January 12, 1995. If the facility is greater than seven years old then the tank must be provided with secondary containment by the time the facility is 15 years old or by January 12, 1989 whichever comes later.

C.6a Acceptable documentation of the facility age will include: dated blueprints, contracts, and insurance forms. If documentation is not on site, it may be possible to date the facility before or after the inspection using other sources (see appendix D, No. 7).

C.7 Based on the wastes stored in the tank system and/or based on the tank or facility age, the inspector should determine when secondary containment is required. The inspector should inform or confirm with the owner/operator during the post-inspection review the date that secondary containment must be installed.

If the date for installing secondary containment has passed prior to the date of inspection and secondary containment is not provided, nor is a variance granted, a serious violation has occurred.

Tank Design and Waste Compatibility

D.1 The written assessment must describe the wastes stored/treated in tanks [§264.191(a)(2)]. Tank material information may be used by the inspector to determine compatibility with wastes stored/treated in them. This is particularly important for 90-day accumulation and/or interim status tanks since waste compatibility will be reviewed solely by the inspector and not a permit writer.

D.2 The written tank integrity assessment must include a description of the design standards of the tank and ancillary equipment [§264.191(a)(1)]. Appendix B, 2a-c provides references for nationally accepted tank design standards. Appendix B-3 provides a list of organizations with up-to-date information on design standards.

D.3 To determine if the tank material is compatible with the wastes stored or treated please see Appendix B, 4a-e.

Corrosion Protection

E.1 The written tank integrity assessment must be on file at the facility by January 12, 1988, and must include a description of existing corrosion protection methods [§264.191(a)(3)].

E.2* The inspector should record the kind of corrosion protection in place for the tank. If the tank system is permitted the inspector should make sure that the protection provided is the same as that specified on the permit. This question provides a flag for unpermitted facilities.

F. Non-enterable, underground tanks--Regulations effective in all states. Because underground tanks cannot be visually inspected, the determination of the soundness of underground tank systems will rely primarily on records verifying the tanks integrity.

F.1a The written tank integrity assessment be on file at the facility by January 12, 1988, and must include the method used to test the tank system for leaks [§264.191(a)(5)].

F.1b-F.1c
The owner/operator is required to conduct a tank integrity test annually [§264.193(i)] and must have the results of the tests on file at the facility [§264.193(i)(4)]. The inspector should inspect the tank integrity test results. Tanks that are leaking or unfit should not be in service unless certified repairs are made, including secondary containment, as provided in [§264.196(e)].

F.1d For non-enterable underground storage tank systems, the leak testing device used for the annual tank integrity test is required to take into account the four variables listed [§264.191(a)(5)(i)].

G.1 Other Tank Types - Tank Integrity
The regulations for other tank types go into effect in all unauthorized states. In authorized states, the regulations go into effect after the state has amended its statute (by 1987 or 1988) [§271.21(e)(2)].

G.1a If the tank is not an underground tank the owner/operator is required to include either a leak test or an integrity test that is certified by an independent, qualified, registered, professional engineer [§264.191(a)(5)(ii)].

G.1b-G.1c
The owner/operator is required to conduct a tank integrity test or otherwise have the overall condition of the tank system assessed by an independent, qualified, registered, professional engineer annually [§264.193(i)(2)]. The owner/operator must have the results of the tests on file at the facility [§264.193(i)(4)].

The inspector should inspect the tank integrity test results. Tanks that are leaking or unfit should not be in service unless certified repairs are made and secondary containment is provided [§264.196(e)].

G.2a If the tank has been assessed by an independent, qualified, registered, professional engineer who has conducted an inspection of the internal tank surfaces, a certification of tank integrity must be on file.

G.2b See Appendix B, 7a-b for a checklist of what should be evaluated when the independent, qualified, registered, professional engineer is conducting an internal inspection [§264.193(i)(2)]. Verify that the engineer has documented the examination of all appropriate factors.

Ancillary Equipment

H.1 The written assessment requested under §264.191(b)(1) must contain a description of feed systems, cutoff and/or bypass systems as well as pressure controls.

H.2-H.3
A leak test or other integrity assessment approved by the Regional Administrator must be conducted annually for ancillary equipment until secondary containment is provided [§264.193(i)(3)]. The inspector should examine logbooks or other records which document that the leak test is conducted annually.

H.4 The inspector should both question the owner/operator and check through logbooks to determine if any tank component has leaked or was found to be unfit.

5.2.3 New Tanks [Checklist IV, New Tank Systems]

New tank systems are those that were installed after July 14, 1986 or ones which commenced to handle hazardous waste after July 14, 1986. Please review the definition of new tank systems in the glossary provided in Appendix C. (Also see Figures 4A and 4B for applicability of the regulations and use of the checklists.)

A. Checklist questions in Section A provide general descriptive information about the tank system. For permitted facilities, or one which has submitted a Part B permit application, this information verifies data already gathered. For other facilities, such as those operating 90-day accumulation tanks, this may be the Agency's first description of the tank system. In these cases, the inspector will be reviewing tank

material, waste compatibility and tank design criteria in order to identify violations and/or to flag potential problems. Much of this section is self-explanatory.

B. The inspector should record the specific components of the waste to evaluate compatibility with tank materials. To obtain this information the inspector may want to use the Part B permit application (if one exists), which contains a written assessment of the tank's integrity, including a description of the wastes. The inspector should question the owner/operator and check other documents, such as manifests, to verify or add to information in the permit application.

Certification of Installation and Tank Tightness

C.1-C.2
The installation of a new tank system must be directly supervised by an independent, qualified installation inspector or an independent, qualified, registered, professional engineer who must provide written statements to the owner/operator certifying that the tank was properly installed. The inspector should review the written statement(s) to ensure that the person supervising the installation was a qualified individual (and not simply a facility employee) and that the tank system was inspected for the appropriate deficiencies prior to covering, enclosing, or placing the tank into use [§264.192(b) and (g)]. See Appendix B-1 for the required certification paragraph.

C.3 Because supervision of installation may be performed by a different expert than one certifying the design of the tank system, the inspector should review the installation log or other relevant documents to verify that installation was completed satisfactorily.

C.4-C.6
Before the tank and ancillary equipment is covered, enclosed, or placed into use it must be tested for tightness [§264.192(d)]. A record of the test and its results must be on file at the facility. The inspector should review the method used to test tank tightness as well as the results of the test.

Secondary Containment

D.1 The existence of an application for a variance will not make any difference in the inspection of a new tank system. Only if a variance is granted can the inspector disregard the record review and visual inspection relating to secondary containment.

D.2 If the facility has not been granted a variance and the new tank system does not have secondary containment, then the facility is clearly in violation of the regulations.

D.3 [§264.193(d)]. See Appendix B, 17-21 for illustrations of secondary containment systems.

D.4* The inspector should ask the owner/operator for any records that describe the materials used for secondary containment. This information is to be used to flag any potential problems, such as incompatibility of wastes for facilities that have not submitted Part B permit applications (interim status tanks or 90-day accumulation tanks).

D.5 A leak detection system must be provided that is designed and operated to detect the failure of either the primary or secondary containment structure, or the presence of any release of hazardous waste or accumulated liquid in the secondary system within 24 hours, or at the earliest practicable time [§264.193(b)(3)].

Double-walled tanks must be provided with a built-in continuous leak detection system capable of detecting a release within 24 hours or at the earliest practicable time [§264(d)(3)(iii)]. Commonly employed leak detection methods are described in Appendix B-8.

D.6 The inspector should review logbooks/records over a randomly chosen period of time to make sure that the leak detection devices operate properly and that facility personnel monitor leak detection points.

D.7-D.9
The inspector should note if the primary containment system was found to be leaking into the secondary containment. This type of leak within the tank system does not have to be reported to EPA, however, the waste

must be removed from the secondary containment system within 24 hours after detection [§264.196(b)(2)]. The facility should provide some evidence that this was accomplished and that the repairs were made to the primary system prior to reuse [(§264.196(e)(3)]. Certification is not required, however. If no evidence can be provided, the inspector should look for the presence of waste or rain water within the secondary containment system that has not been removed as required (see Visual Inspection Checklist VII).

Aboveground Ancillary Equipment Exemptions

E.1-E.5
Certain aboveground components of tank systems are exempt from the secondary containment requirements if they meet the criteria in §264.193(f). The inspector should ask if the tank system meets any of these criteria and verify that daily inspections are conducted and are documented. During the visual inspection, the inspector should keep in mind that components without secondary containment must meet the §264.193(f) criteria (e.g., straight aboveground piping, sealless pumps, magnetic coupling rings).

Corrosion Protection

F.1-F.2
For new tank systems or components in which the external shell of a metal tank or component will be in contact with the soil or with water, the owner/operator is required to provide the type and degree of corrosion protection recommended by a corrosion expert [§264.192(f)]. The inspector should verify that the corrosion protection employed is what was recommended. The expert's recommendation is required as a part of a written assessment of the tank system's integrity which must be on file at the facility [§264.192(g)].

F.3 If cathodic protection is field fabricated the design and installation must be supervised by a corrosion expert.

Releases

The occurrence of leaks/spills or the lack of leaks/spills should be verified during the visual inspection.

5.2.4 Special Wastes [Checklist V, Tank Systems that Store or Treat Ignitable or Reactive Wastes]

The inspector may want to bring extra copies of this checklist to all facilities that have not submitted a permit application, in case waste is determined to be reactive or ignitable based upon information gathered during the site inspection.

A.1 Ignitable and reactive wastes must not be placed in tank systems unless they are treated or mixed before or immediately after placement in a tank system so that the resulting mixture is no longer ignitable or reactive, or so that it no longer poses a threat to human health [§294.198(a)]. The inspector should carefully review the procedures used by the owner/operator to store/treat ignitable or reactive wastes in the tank system reviewing any relevant logbook entries and by questioning the owner/operator.

A.2 The inspector should check the logbook or any other applicable records on site.

A.3 The inspector should visually inspect the system to make sure that the temperature around the tank would not allow it to explode or that it is protected from any objects or chemicals that could cause a reaction.

A.4 Refer to Appendix B 10a-e for the National Fire Protection Association Standards for the distances that ignitable wastes (materials) must be from public ways and adjoining properties.

A.5 The regulations stipulate that hazardous waste must not be placed in a tank system that has not been decontaminated and that previously held an incompatible waste or material unless steps have been taken to eliminate any risk to human health [§264.199(b)]. The inspector can only question the owner/operator and examine logbooks to answer this question. Appendix B, 9a-f will provide information on incompatible waste types.

5.2.5 Release Response [Checklist VI]

The release response checklist will be used during the record review and the visual inspection. The inspector may wish to take extra copies of the checklist to each site since a number of tank systems may be identified as having a release during the visual inspection, if not during the record review.

A.1-A.1a
The regulations require that, when there is a release to the environment of a quantity more than 1 pound, or any quantity that has not been immediately cleaned up, the owner/operator must notify the Regional Administrator within 24 hours of detection. Within 30 days of the release a report [as described in §264.196 (d)(3)] must be submitted to the Regional Administrator. During the file review, the inspector should record the dates of each release for each tank system at a facility and the completeness of each report. During the visual inspection, the inspector can verify that a release to the environment was or was not cleaned up. The inspector should examine the notification for greater detail [§264.196(d)].

The notification requirement is met if the release was reported pursuant to Part 302 (Designation, Reportable Quantities, and Notification). In that case, the owner/operator should have some record of calling the National Response Center in Washington D.C.

A.2 Removal from service of the leaking tank component should be reflected in the owner/operator's logbook. Where a tank containing waste is removed from service, the inspector should note what the owner/operator did with the waste and if there is documentation of the waste being shipped off-site or into another tank, etc. [§264.196(a)].

A.3 If the release was from the tank system, the owner/operator must remove waste within 24 hours of detection or: a) the owner/operator must demonstrate that it is not possible to remove wastes in 24 hours and, b) at the earliest practicable time, remove as much waste as necessary to prevent further release of hazardous waste to the environment and to allow appropriate inspection and repair.

If material is released to the secondary containment system, all materials must be removed in 24 hours or in as timely a manner as is possible to prevent harm to human health and the environment.

A.4* The inspector should question the owner/operator about methods used to contain visible releases to the environment. In addition, the inspector should check the logbook to verify methods [§264.196(c)].

A.5 If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the owner/operator must provide the component of the system from which the leak occurred with secondary containment before it can be returned to service, unless the leak is an aboveground portion of a tank system that can be inspected visually [§264.196(e)(4)].

A.6 If the owner/operator has made extensive repairs to a tank system (e.g., installation of an internal liner, repair of a ruptured primary containment or secondary containment vessel) then the tank system may not be returned to service until the owner/operator has obtained certification by an independent, qualified, registered, professional engineer that the repaired system is capable of handling hazardous wastes without release for the intended life of the system [§264.196(f)]. The required certification paragraph can be found in Appendix B-1.

5.3 Tank System Inspection

5.3.1 Visual Inspection of Tank System [Checklist VII, Visual Inspection]

After reviewing the inspection logs and other recordkeeping requirements for the hazardous waste tank systems at a facility, the inspector will want to see the system itself. Depending upon the system (e.g., above- vs. underground, cement vs. metal), the inspector will be looking for different signs of non-compliance with the regulations. Obviously, the ability to visually inspect underground tanks is severely limited. Therefore, the determination of sound underground tank systems will rely primarily on records from tightness tests covered under checklists III or IV.

Aboveground portions of tank systems can be examined by the inspector. A complete description of how to conduct a thorough external tank examination can be found in the OSWER Policy Directive (see appendix D, No. 11). This checklist provides an easy reference to the inspector for points that should be noted as evidence of potentially unfit tank systems. Checklist Section A is organized according to tank type (e.g., aboveground) and tank materials (e.g., metal, FRP, concrete). Section B covers underground tanks. Ancillary equipment, secondary containment, and corrosion control are also covered. This checklist should be included for all tank systems except small quantity generators. Not all sections of the checklist will be applicable to all tank systems.

A. §264.194(a) stipulates that hazardous waste cannot be placed in tanks if they can cause it to rupture, leak, corrode or otherwise fail. The presence of any of the identified points in the checklist indicates that the tank may be corroding, leaking, rupturing or otherwise failing.

B. Underground Tanks

B.1 If the underground tank system is a new system, the regulations require that the certified written assessment of tank integrity include a determination of design or operational measures that will protect the tank system against potential damage if the tank system is likely to be adversely affected by vehicular traffic [§264.192(a)(4)].

B.2 For new underground tank systems or components, the regulations require that the tank system must be provided with backfill material that is non-corrosive, porous, and homogeneous. The backfill material must be placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported [§264.192(c)]. The inspector should make sure that the ground is not slumping in the area of the underground tank or that clays are not used as backfill material.

C. Spill and Overfill Controls

C.1 The inspector should determine whether or not dry disconnect couplings are being used. If they are not being used, the inspector should determine if the owner/operator is collecting and properly disposing of

any spilled/leaked materials. Appendix B-15 illustrates different types of couplings.

C.2 The inspector should determine that overfill prevention controls are present and in good working order. Appendix B-15 illustrates the elements of an overfill prevention system.

C.3 Small quantity generators are required to have at least 60 cm (2 feet) of freeboard for uncovered tanks [§265.201(b)(3)]. This should be considered a minimum.

C.4 Evidence of overtopping or major spills would include staining/corrosion of paint on the tank or the tank surface itself. Other evidence would include pooling of waste material in a diked area or non-point discharge of contaminated ground water into a surface water body if one is located nearby the tank system. If there is evidence of a release to the environment include checklist VI (Release Response) for the tank system.

D. The Inspection of Ancillary Equipment
The inspector should ask the owner/operator to trace the inspection route from the process or unloading area to the tank where waste is stored or treated. The exit line from the tank system should also be covered by the inspector. Note the presence of any corrosion, ruptures or other indicators of system failure.

D.1-D.3
The regulations require that all ancillary equipment be tight and properly inspected and maintained. Ancillary equipment includes any device (e.g., piping, pumps, valves, etc.) used to distribute, meter, or control the flow of hazardous waste from its point of generation to a storage or treatment tank, between hazardous waste storage and treatment tanks to a point of disposal on-site, or to a point of shipment for disposal off-site (§260.10).

E. If a permitted facility changes its equipment, the facility is required to apply for a permit modification. It is important that the inspector verify that the facility is using the same type of equipment specified in the permit.

F. Secondary Containment

F.1 The regulations require that for liner systems and vault systems the secondary containment component must be able to hold 100 percent of the volume of the largest tank within its boundary [§264.193(e)(1)(i) and (e)(2)(i)] to be designed and/or operated in such a way as to prevent the collection of run-on and precipitation from entering secondary containment unless sufficient excess capacity has been provided to contain precipitation from a 25-year, 24-hour rainfall event [§264.193(b)(1)(ii) and (b)(2)(ii)].

The inspector should do a rough calculation of the volume of the secondary containment by estimating the dimensions of the containment structure or by asking the owner/operator for the dimensions. Ask the owner/operator if she/he knows or can refer to a document with the volume of run-on from a 25-year/24-hour rainfall event for this area. If not, it is likely that the owner/operator has not taken into consideration the 25-year/24-hour-precipitation-event standard when designing the external liner or vault system.

F.2 The inspector should see if precipitation is collected in the secondary containment system. If run-on or precipitation has collected in secondary containment, it must be removed within 24 hours [§264.193(c)(4)]. Unless it has rained within 24 hours of the inspection, water in the secondary containment system constitutes a violation.

F.3 If there is water collected in secondary containment and it is contaminated, it must be managed as a hazardous waste. Any hazardous waste leaked or spilled into the secondary containment system must also be removed within 24 hours [§264.196(B)(2)].

F.4 [§264.193(e)(3)]. Double-Walled Tanks

F.4a The inspector should determine what type of corrosion protection is being used. Because these tank systems are typically underground, it may be that the inspector can only verify this in the records review. However, where portions of tank systems are aboveground, the inspector may be able to verify that

corrosion protection is employed by examining the visually accessible portions of the outer shell for any blistering or rust or other signs of corrosion [§264.192(a)(3)(ii)].

F.4b The inspector should examine any leak detection devices, if possible, to ensure that they are in good working order.

F.5 Vaults [§264.193(e)(2)].

F.5a Secondary containment is required so as to prevent the release of hazardous wastes into the environment. Concrete is a porous material so the surface of any concrete that is used in secondary containment must be made impermeable, and must also be compatible with the wastes stored/treated in the tank system [§264.193(b)(1), (b)(1)(iv) and (b)(2)(iv)].

In addition, the inspector should review Appendix B. The table on B-5 provides information on the compatibility of lining types with particular chemical groups. The table on B-6a and B-6b gives the general characteristics of impermeable barriers for concrete vaults.

F.6 Liners [§264.193(e)(1)].

F.6.a-d
The inspector should see that the liner covers the surrounding earth to prevent lateral as well as vertical migration [§264.193(b)(1)(iv)]. In addition, the inspector should verify that the liner is free of cracks or gaps [§264.193(b)(1)(iii)]. If the liner is concrete, there must be a protective coating or synthetic liner that is impermeable as well as compatible with the waste material.

G. Corrosion Control
The inspector should review Appendix B. The table on B-13 describes several different types of localized corrosion and the table on B-14 describes environments which are corrosive to tanks constructed of different types of metals. Several types of corrosion control devices are also illustrated.

G.1* If a tank is sitting in water it will corrode faster than if it is being operated in a dry environment.

G.2 It is important that porous material such as dry crushed rock, gravel or sand be used as backfill material because it is less corrosive and promotes drainage and is more supportive.

G.3* Metal structures in close vicinity of the tank system (within 1 foot) may adversely affect the cathodic protection of a tank system.

G.4-G.7
For additional information the inspector should refer to Chapter 5 of the OSWER Policy Directive (see appendix D, No. 11).

5.3.2 Inspection of Closed Tank Systems [Checklist VIII, Closure, Post-Closure]

A.1 Tank systems with secondary containment may close under the requirements of §264.197(a) or §264.197(b). If the owner/operator chooses to 'clean close', the inspector should examine the site of the tank system to ensure that all waste residues and contaminated tank system components have been removed and that no contaminated materials or soils are left in the area.

B.1 If the owner/operator demonstrates that not all contaminated soils can be removed or decontaminated as required by the regulations, then the owner/operator must close the tank system and perform post-closure care as if the tank system were a landfill [§264.197(b)].

The inspector should make sure that the owner/operator was unable to remove and decontaminate all wastes and components of the tank system. For example, if the contamination is over an acre in area and is several feet deep, the contaminated soil would be too extensive to 'practicably' remove and dispose.

B.2a-B.2b
The final cover must be designed to: minimize the migration of liquids into and through the tank system; function with minimum maintenance, promote drainage and minimize erosion; accommodate settling and subsidence; and have a permeability less than or equal to the permeability of any bottom liner or natural subsoils present [§264.310(a)].

B.2c The inspector should refer to §264.97 (general ground-water monitoring requirements). The inspector should determine, through an inspection of facility records and a visual inspection, if there is a ground-water monitoring system in place and if it is adequate.

C. Section 264.197(c) requires that if the owner/operator has a tank system that does not have secondary containment requirements, the owner/operator must, in accordance with §264.193(g), develop a closure plan for removing all waste residues, contaminated containment system components, contaminated soils, structures and equipment [§264.197(a)] and a contingency plan for closing the tank system as a landfill [§264.197(b)].

C.2 The contingency plans for closing a tank system as a landfill must be submitted with the permit application [§264.197(c)(2)]. The inspector should review the closure plan prior to the inspection if the tank system is permitted. If the tank system has interim status, the inspector should make sure that the contingency plan is on file at the facility and is adequate.

The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and post-closure plans (that is, it must reflect the costs of closing the tank system as a landfill) if those costs are greater than closing the tank system by removing wastes and contaminated materials as specified under §264.197(a) [§264.197(c)(3)].

In addition, financial assurance must be based on the highest of the two cost estimates for closure and post-closure care [§264.197 (c)(4)].

For the purpose of the contingent closure plans, a tank system is considered a landfill and must comply with the closure, post-closure, and financial requirements for landfills under Subparts G and H of Part 264.

6.0 POST-INSPECTION REVIEW

Prior to leaving a site inspection, the inspector should inform the owner/operator of any violations that were observed. The checklist, in addition to documenting violations, also flags areas of concern. With facilities that are permitted or applying for a permit, these concerns can be brought to the attention of the permit writer. However, at other facilities, if there is no direct violation, the areas of concern should be mentioned to the owner/ operator prior to concluding the inspection.

Because the inspector examines and collects a great deal of data while inspecting a facility operating hazardous waste tanks, it is imperative that the inspector carefully review and summarize the information after conducting the inspection. The post-inspection review should be used to fill in any information gaps (e.g., if there was not proper documentation of the tank age for an existing facility, age information may be available elsewhere) to evaluate more complex information which could not be evaluated on site (e.g., whether or not wastes are compatible, or whether or not the environment is corrosive), and to summarize any regulatory violations.

A form is provided in Appendix A for inspectors to use to summarize the results of the inspection. The inspector should ask himself/herself the following questions:

- Is the owner/operator maintaining complete files?
- Are the owner/operator's records verified by the visual inspection of the tank site?
- Will the owner/operator (existing tanks) meet the regulatory deadline for installing secondary containment?
- Were there any signs of unreported releases, particularly if they are not contained or cleaned up?

Although a facility may not have violated specific regulations, the inspector may have noticed conditions at the facility which may indicate potential problems or violations. The inspector should note the following in the summary sheet:

- High resistivity or other indicators of high corrosion potential where metal tank components are exposed to the soil
- Poor maintenance
- Poor procedures for inspecting the tank system
- Incomplete, illegible, and/or inconsistent logbook notes.

APPENDICES

APPENDIX A
INSPECTION CHECKLISTS

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

Inspector Name

Address (Region)

Telephone Number

Date of Inspection

Facility Identification

A.1 _____ Facility Name

B.1 _____ Facility Address

B.2 _____ City

B.3 _____ State

B.4 _____ Zip

B.5 _____ Mailing Address (if different)

B.6 _____ County

C.1 _____ Nature of business; identification of operations

D.1 _____ EPA I.D. Number

E.1 _____ Facility Contact

E.2 _____ Job Title

E.3 ( ) _____ Contact Work Phone

F.1 Identification of Hazardous Waste Tank Systems at this Facility

_____

_____

_____

_____

_____

_____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

I. Small Quantity Generators - Compliance with § 265.201

A.1 _____ A.2 _____
Tank volume (gallons) Tank description (e.g. aboveground, steel, lined)

A.3 _____
Tank location (e.g. inside on cement floor, outside on asphalt pad)

B.1 Material Stored: Be as specific as possible(e.g., 20% Methylene chloride, 30% 1,1,-trichloroethane, 50% mineral spirits)

_____ _____
Hazardous waste no. Description

B.2 Does this tank ever contain waste other than the above? _____ yes _____ no

If so, list other waste:

EPA Hazardous Waste Number	Waste Description
_____	_____
_____	_____
_____	_____

B.3 Are hazardous wastes placed in tanks that are compatible with the waste so that the tank or inner liner may not fail prematurely? _____ yes _____ no

C.1 Are wastes being stored in tanks for greater than 180 days? _____ yes _____ no

C.2 Is the disposal site greater than 200 miles away? _____ yes _____ no

C.3 Are wastes being stored in tanks for greater than 270 days? _____ yes _____ no

C.4 SQG, who store waste greater than 180 days (270 days if shipped over 200 miles) or who exceed the 6,000 kg limit. Has the owner/operator applied for an operating permit? _____ yes _____ no

Facility Id. _____ Tank System Id. _____

I. Small Quantity Generators - Compliance with § 265.201

C.5 Does the owner/operator inspect the tank system routinely for the following:

Discharge control equipment each operating day	yes	no
Data from monitoring equipment (e.g. gauges) each operating day	yes	no
Level of waste in tank each operating day	yes	no
Materials for signs of corrosion weekly	yes	no
Area around tank for spills or leaks weekly	yes	no

D. Special wastes

D.1 Is the owner/operator storing ignitable or reactive wastes so that it does not generate heat, fire, violent reactions, gases that are flammable, toxic dusts, or other means to threaten human health?

yes _____ no _____ NA _____

D.2 Does the owner/operator follow appropriate procedures for reactive of ignitable wastes? (See Special Wastes, Checklist VI)

yes _____ no _____ NA _____

E.1 Is the tank labeled 'Hazardous waste"?

yes _____ no _____

E.2 Tank Condition - Indicate presence of any of the following

discolored paint or rust anywhere on tank system	yes	no
blister, cracks, bulges or other signs of potential failure	yes	no
worn hoses, rips in liners,	yes	no

E.3 Does the area around the tank show any evidence of spills (e.g. discoloration, dead vegetation)?

yes _____ no _____

E.4 Are uncovered tanks operating with a minimum of 2 feet (60 cm) freeboard or are they equipped with containment structure?

NA _____ yes _____ no _____

Facility Id. _____ Tank System Id. _____

I. Small Quantity Generators - Compliance with § 265.201

E.5 In tanks with a continuous feed systems, is the system equipped with a cut-off or by-pass system?

NA	yes	no
_____	_____	_____

F. Preparedness and Prevention Plan Compliance

F.1 Is there an emergency response plan?

yes	no
_____	_____

F.1 Internal communication or alarm system available

yes	no
_____	_____

F.2 Is telephone or other device capable of summoning emergency assistance from local police, fire or other emergency response teams available?

yes	no
_____	_____

F.3 Are portable fire extinguishers and spill control equipment available and in operational condition?

yes	no
_____	_____

F.4 Water available to supply water hose streams

yes	no
_____	_____

Facility Id. _____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

II. Documentation of General Inspection Requirements under §264.195, 265.195

A.1 Inspection plan/procedures adequately thorough in order to identify problem areas and small leaks

_____ yes _____ no

A.2 Documented inspection as scheduled in permit (_____) for overfill controls

_____ yes _____ no _____ N/A

A.2a Interim status and 90-day accumulation tank systems must have the overfill controls inspected (and documented) each operating day

_____ yes _____ no _____ N/A

A.3 Documented daily inspection of aboveground portions of tank system

_____ yes _____ no

A.3a Use of inspection devices

_____ yes _____ no _____ provide name of device used

A.4 Documented daily inspection of monitoring and leak inspection data

_____ yes _____ no

A.5 Documented daily inspection of construction materials of both tank system and secondary containment, and inspection of tank location and secondary containment for signs of erosion or releases

_____ yes _____ no

A.6 Confirmation of proper operation of the cathodic protection system within six months of initial installation

_____ yes _____ no _____ N/A

date of installation _____ date of inspection _____

A.6a Annual inspection of cathodic protection after installation

_____ yes _____ no _____ N/A

A.7 Bimonthly inspection of all sources of impressed current

_____ yes _____ no _____ N/A

A.7a Method used to inspect impressed-current system _____

Facility Id. _____ Tank System Id. _____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

III. Existing Tank Systems - Compliance with § 264.191, 265.191

A.1 _____ A.2 _____
Tank volume (gallons) Tank type (above-,on-,in-,below ground)

B.1 Material Stored: Be as specific as possible (e.g., 20% Methylene chloride, 30% 1,1,-trichloroethane, 50% mineral spirits)

EPA Hazardous Waste Number	Waste Description
_____	_____
_____	_____
_____	_____
_____	_____

C. Secondary containment

C.1 Does this tank system have secondary containment?

_____ yes _____ no

If yes, see Checklist IV, if no continue below

C.2 Has facility been granted a variance from secondary containment? _____ yes _____ no

C.3 Is a written assessment of tank system integrity on file? _____ yes _____ no

C.4 If assessment is provided, has it been reviewed and certified by a registered, professional engineer? _____ yes _____ no

C.5 _____ Tank Age C.5a Documented _____ yes _____ no

C.6 _____ Facility Age C.6a Documented _____ yes _____ no

C.7 _____
Date when secondary containment is required

III. Existing Tank Systems - Compliance with § 264.191, 265.191

D. Design standards

D.1 The tank is constructed with: (be as specific as possible e.g. fiberglass-reinforced plastic, mild steel, nickel based alloy).

_____

D.2 Document evaluates tank system in accordance with the most recent applicable design standards _____ yes _____ no

D.3 Is tank material generally compatible with waste? _____ yes _____ no

E. Corrosion protection measures (applicable to tank systems with metal components in contact with soil or water)

E.1 Document describes existing corrosion protection measures? _____ yes _____ no

E.2 Type of system employed (Coatings, Wraps, Electrical isolation devices, Sacrificial-anode, Impressed-current)

_____

F. Non-enterable, underground tanks

F.1a Method of leak testing used _____

F.1b Verification of annual testing _____ yes _____ no

F.1c Tank found to be tight _____ yes _____ no

F.1d Leak testing device accounts for following changes:

Temperature _____ yes _____ no

High water table _____ yes _____ no

Tank end deflection _____ yes _____ no

Vapor pockets _____ yes _____ no

G. Other tank types

G.1a Method of leak testing used _____

G.1b Verification of annual testing _____ yes _____ no

G.1c Tank found to be tight _____ yes _____ no

III. Existing Tank Systems - Compliance with § 264.191, 265.191

G.2 Internal inspections

G.2a Certification by registered, professional engineer _____ yes _____ no

G.2b Has the engineer checked and documented inspection of all appropriate factors? _____ yes _____ no

H. Tank ancillary equipment

H.1 Feed systems, Safety cutoff and/or bypass systems, pressure controls are described in written assessment _____ yes _____ no

H.2 Has ancillary equipment been leak tested or undergone other approved integrity assessment annually? _____ yes _____ no

H.3 Method of leak testing used _____

H.4 Have any of the leak tested tank system components been found to be leaking or unfit? _____ yes _____ no

If any of the tanks system components have failed the examinations or leak tests, Release Response Checklist VI should be included for this tank system.

Facility Id. _____ Tank System Id._____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

IV. New Tank Systems - Compliance with §264.192

A. New Tank design

A.1 _____ A.2_____
Tank volume (gallons) Tank type(above-,on-,in-,below ground)

A.3 _____ A.4_____
Tank Dimensions Tank shape (spherical, cylindrical,etc.

A.5 The tank is constructed with: (be as specific as possible e.g. fiberglass-reinforced plastic, mild steel, nickel based alloy)

_____

B. Material Stored: Be as specific as possible e.g. (20% Methylene chloride, 30% 1,1,-trichloroethane, 50% mineral spirits)

EPA Hazardous Waste Number	Waste Description
_____	_____
_____	_____
_____	_____
_____	_____

C. Tank System Installation

C.1 Certification of inspection and supervision of installation and design by independent installation expert or qualified engineer _____ yes _____ no

C.2 Did the inspection include the following:
Weld breaks _____
Punctures _____
Scrapes on protective coating _____
Cracks _____
Corrosion _____
Other damage or inadequate construction_____

C.3 Has a detailed description of the installation been provided? _____ yes _____ no

C.4 Has the tank passed a test for tightness prior to being covered or placed in use? _____ yes _____ no

IV. New Tank Systems

C.5 Has the ancillary equipment (e.g. piping) passed a test for tightness? _____ yes _____ no

C.6 Has a detailed description of the tightness testing been provided? _____ yes _____ no

D. Secondary containment - Compliance with §264.193

D.1 Has the facility been granted a variance? If yes, go to Section F on this checklist. _____ yes _____ no

D.2 Is secondary containment for new tanks and ancillary equipment installed? _____ yes _____ no

D.3 Secondary containment is: (circle one) liner, vault, double-walled component

D.4 Secondary containment materials are _____

D.5 Type of leak detection equipment employed _____

D.6 Record of leak detection operation available? _____ yes _____ no

D.7 Have any leaks from the primary system into secondary containment been detected? _____ yes _____ no

D.8 Was leaked waste removed from the secondary containment system within 24 hours? _____ yes _____ no

D.9 Was the repair to the primary system documented prior to returning tank into service? _____ yes _____ no

E. Exemption of secondary containment for tank systems or component §264.193(f)

E.1 Is all aboveground, straight piping that is not covered by secondary containment inspected daily? _____ yes _____ no

E.2 Are all welded flanges, welded joints, and welded connections inspected for leaks daily? _____ yes _____ no

E.3 Are all sealless or magnetic coupling pumps visually inspected for leaks daily? _____ yes _____ no

E.4 Are all pressurized, aboveground piping systems with automatic shutoff devices visually inspected for leaks daily? _____ yes _____ no

IV. New Tank Systems

F. External Corrosion Protection for metal components or equipment §264.192

F.1 Has a corrosion potential assessment been prepared by a corrosion expert? _____ yes _____ no

F.2 Type of corrosion protection installed _____ (coatings, wraps, electrical isolation devices, sacrificial-anode, impressed-current)

F.3 Has a corrosion expert supervised the installation of any field fabricated corrosion protection (e.g. cathotic-protection devices) _____ yes _____ no

If any of the tank system components have failed tightness testing or have resulted in leaks that had releases outside the secondary containment, Release Response Checklist VI should be included for this tank system.

Facility Id. _____ Tank System Id. _____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

V. Tank Systems that Store or Treat Ignitable or Reactive Wastes

Compliance with § 264.198

A. Special Requirements for ignitable or reactive wastes

A.1 Has waste been treated, mixed or otherwise rendered nonreactive or not ignitable (except in emergency conditions) so that the mixture is no longer ignitable or reactive?

_____ yes _____ no

A.2 Has complete chemical identification of waste compatibility been determined prior to mixing of wastes?

_____ yes _____ no

A.3 Is the tank protected from conditions that may cause it to ignite (e.g. use of spark proof tools) or protected from contact with materials that may cause it to react?

_____ yes _____ no

A.4 Is the required National Fire Protection Association distance between waste management area (ignitable wastes) and public ways and adjoining properties maintained?

_____ yes _____ no

A.5 Has an appropriate method of tank system decontamination been selected based on the type of waste residues remaining in a receiving vessel?

_____ yes _____ no

Facility Id. _____ Tank System Id. _____

HAZARDOUS WASTE TANK INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

VI. Release Response - Compliance with § 264.196

A.1 Notification of releases to Regional Administrator (from file review)
date: _____ description: _____
_____ _____
_____ _____

A.1a Did the O/O report to the Regional Administrator within 30 days of each release with the following information
- likely route of migration of release
- characteristics of surrounding soil
- results of sampling
- proximity to downgradient drinking water, surface water and population
- description of response actions planned or taken

_____ yes _____ no _____ N/A

A.2 Did the O/O immediately remove the tank component from service after spill/leak?

_____ yes _____ no _____ not able to verify _____ N/A

A.3 Was waste removed from leaking component of the tank system and from secondary containment?

_____ yes _____ no _____ N/A

A.4 Were visible releases to the environment contained?

_____ yes _____ no _____ N/A

A.5 Has secondary containment, repair, or closure of the tank system been provided?

_____ yes _____ no _____ N/A

A.6 Was the repair certified by an independent, qualified, registered, professional engineer?

_____ yes _____ no _____ N/A

Facility Id. _____ Tank System Id. _____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

VII. Visual Tank System Inspection General Operating Requirements §264.194

A. Aboveground Portions § 264, 265.194(a)
A.1 Metal Tanks -

Look for:	Indicate Presence
Gross leakage,	_____
Major corroded areas	_____
Deterioration (e.g blisters)	_____
Discolored paint	_____
Cracks (nozzle connections, in welded seams, under rivets)	_____
Buckles and bulges	_____
Defective manhead gaskets	_____
Corrosion of tank tops or roofs	_____
Corrosion around nozzles and valves	_____
Erosion around foundation, pads and secondary containment	_____
Cracks in concrete curbing and ringwalls	_____
Rotting of wooden supports	_____
Welds and anchor bolts between tank bottoms and ringwalls	_____
Deterioration of protective coatings such as discoloration and film lifting	_____

A.2 Fiberglass-Reinforced Plastic Tanks -

Look for:	
Gross leakage	_____
Bending, curving or flexing	_____
Longitudinal cracks in horizontal tanks,	_____
Vertical cracks in vertical tanks	_____

Facility Id. _____ Tank System Id. _____

VII. Visual Tank System Inspection

A.3 Concrete Tanks - Above Ground Portions

Look for:	Indicated Presence
Gross leakage	_____
Cracks	_____
Porous areas permeable to liquid (wet spots)	_____
Deterioration of protective coatings such as discoloration and film lifting	_____

B. Underground tanks §264.192

B.1 Is the (new) tank protected from vehicular traffic (paving over tanks should extend at least 1 ft beyond perimeter in all directions)	_____ yes	_____ no	_____ NA
B.2 If the backfill is not covered, is it porous and homogeneous?	_____ yes	_____ no	_____ NA
B.3 Is there water pooling or depressions in the area of the tank?	_____ yes	_____ no	_____ NA

C. Spill and Overfill Prevention Measures §264.194

C.1 Are spill prevention controls (e.g. check valves, dry disconnect couplings) in use?	_____ yes	_____ no
C.1a Is there any evidence of spillage from disconnect or uncoupling operations	_____ yes	_____ no
C.2 Are overfill prevention controls (e.g. level sensing devices, high level alarms) present and operational?	_____ yes	_____ no
C.3 Is sufficient freeboard maintained in uncovered tanks to prevent overtopping due to wave or wind action or by precipitation?	_____ yes	_____ no
C.4 Is there any evidence of overtopping or major spills	_____ yes	_____ no

Facility Id. _____ Tank System Id._____

VII. Visual Tank System Inspection

D. Inspection of Ancillary Systems § 264.194

D.1 Inspect piping for the following:	Indicate Presence
Pipe bends, elbows, tees, and other restrictions for leaks, external corrosion and rust spots	_____
Deterioration (e.g blisters) and discolored paint	_____
Orifice plates deteriorated	_____
Throttle valves w/broken stems, missing handles	_____
Wear and tear in flexible hoses	_____
Traffic passing over hoses	_____
Vibration or swaying of pipe systems while pumping	_____

D.2 Inspect pumps and compressors for the following:	Indicate Presence
Foundation cracks	_____
Excessive vibration or cavitation of pumps	_____
Leaky pump seals	_____
Missing anchor bolts	_____
Excessive dirt, burning odors or smoke	_____
Depleted lubrication oil reservior in compressor	_____

D.3 Inspect heat exchangers and vapor control systems for:	Indicate Presence
rust spots or blisters	_____

E. Auxillary systems for permitted tanks §270.16

Is the following equipment the same as specified on permit and is it operational?

E.1 Level Sensor _____ Identification	_____ yes	_____ no
E.2 Alarm System _____ Identification	_____ yes	_____ no
E.3 Spill proof couplings, entry points _____ Ident.	_____ yes	_____ no
E.4 Safety Cutoff or Bypass System	_____ yes	_____ no
E.5 Pressure controls (vents)	_____ yes	_____ no

Facility Id. _____ Tank System Id. _____

VII. Visual Tank System Inspection

F. Secondary Containment § 264.193

F.1 Will the secondary containment (liners and vaults) contain 100% of the design capacity of the largest tank in its boundary plus a 25 yr-24 hr rainfall? _____ yes _____ no

F.2 Is water collected in secondary containment system? _____ yes _____ no

F.3 Does any water in secondary containment system appear discolored or otherwise contaminated or is there evidence of waste within the containment system? _____ yes _____ no

F.4 Double-walled tanks: §264.193(e)(3)

F.4a If metal, is there appropriate corrosion protection for the outer shell? _____ yes _____ no

F.4b Does it have an operational, built-in continuous leak-detection system? _____ yes _____ no

F.5 Vaults:§ 264.193(e)(2)

F.5a Does all concrete, including sumps, have liners or coatings? _____ yes _____ no

F.5b Is a vault constructed with chemically resistant water stops at all joints? _____ yes _____ no

F.5c Is there deterioration of protective coatings such as discoloration and film lifting? _____ yes _____ no

F.5d Are there any cracks visable in the concrete? _____ yes _____ no

F.6 Liners: § 264.193(e)(1)

F.6a Does the liner cover all the surrounding earth likely to come into contact with wastes, including berms and dikes? _____ yes _____ no

F.6b If clay liners, do liners show signs of drying and cracking ? _____ yes _____ no

F.6c If polymeric liners, do liners show signs of punctures deterioration due to sun light, chemical spills, rips, tears, gaps, or cracks? _____ yes _____ no

F.6d If a concrete liner, is there any deterioration of its protective coating? _____ yes _____ no

Facility Id. _____ Tank System Id. _____

VII. Visual Tank System Inspection

G. Corrosion Control (metal tank and metal components in-on-or underground)

G.1	Presence of trapped water near tank system (If underground tank system, is water pooling in area above tank location?)	yes	no
G.2	The use of dry, crushed rock or gravel as backfill material	yes	no
G.3	Existence of nearby visible metal structures	yes	no
G.4	Coatings or wraps		
G.4a	Is the coverage complete?	yes	no
G.4b	Has the cover or wrap dried, cracked or dissolved?	yes	no
G.4c	Has the coating or wrap been damaged by spills?	yes	no
G.5	Electrical isolation devices		
G.5a	Are they adequate depending upon the number of nearby, underground metal structures?	yes	no
G.5b	Are the devices damaged in any way?	yes	no
G.6	Sacrificial-anode system		
G.6a	How long has it been in place?	yes	no
G.6b	Have the anodes decreased significantly in size?	yes	no
G.6c	Is the sacrificial-anode system damaged?	yes	no
G.7	Impressed-current system		
G.7a	How long has it been in place?	yes	no
G.7b	Have the current requirements changed over time?	yes	no
G.7c	Is the impressed-current system damaged?	yes	no
G.7d	Is the impressed-current system properly maintained?	yes	no

Facility Id. _____ Tank Id. _____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Inspection Checklist

VIII. Closure, Post-closure Care - Compliance with § 264.197

A. Tank Systems with Secondary Containment - § 264.197(a) (clean closure)

A.1 Visual verification of clean closure _____ yes _____ no _____ NA

indicate if done

Tank system materials removed _____

Verification of proper disposal of contaminated equipment _____

Contaminated soils and residues disposed or treated properly _____

B. Tank systems that cannot be practicably decontaminated - § 264.197(b)

B.1 Has the owner/operator demonstrated satisfactorily that all contaminated soils cannot be removed? _____ yes _____ no _____ NA

B.2 Closure of tank site meeting § 264.310 landfill requirements

B.2a Does contaminated area have appropriate final cover? _____ yes _____ no

B.2b Is owner/operator maintaining cover integrity ? _____ yes _____ no

B.2c Is O/O monitoring ground water according to Subpart F? _____ yes _____ no

C. Tank Systems without Secondary Containment - § 264.197(c)

C.1 Has O/O prepared a closure plan for §264.197(a) and a contingency plan for §264.197(b) which were submitted to EPA? _____ yes _____ no

C.2 If the closure plans have not been submitted, are they on file at they facility? _____ yes _____ no

C.3 Is or has the facility closed this tank system at the present time? _____ yes _____ no

If yes, evaluate closure with appropriate evaluation in A or B above.

Facility Id._____

HAZARDOUS WASTE TANK SYSTEM INSPECTION GUIDANCE

Hazardous Waste Tank System Post-Inspection Form

1. If existing tank systems are present, when is secondary containment required?

Tank Id.	Date Secondary Containment is Required

2. Description of Violation / Regulation Violated / Tank System or Component

a. _____ _____ _____
_____ _____ _____

b. _____ _____ _____
_____ _____ _____

c. _____ _____ _____
_____ _____ _____

d. _____ _____ _____
_____ _____ _____

e. _____ _____ _____
_____ _____ _____

3. Potential Problems

_____
_____
_____
_____
_____
_____

If the facility if applying for a permit, inspector should refer comments to permit writer. For all other facilities, inspector should discuss potential problems with owner/operator.

4. Enforcement Action Recommended

_____
_____
_____

APPENDIX B
TECHNICAL APPENDIX

A sample statement of the form required by Sec. 264.192(g), including the Section 270.11(d) truthfulness certification, follows:

> I, [Name], have supervised a portion of the design or installation of a new tank system or component located at [Address], and owned/operated by [Name(s)]. My duties were: [e.g., preinstallation inspection, testing for tightness, etc.], for the following tank system components [e.g., the tank, vent piping, etc.], as required by the Resource Conservation and Recovery Act (RCRA) regulation(s), namely, 40 CFR 264.192 [Applicable Paragraphs (i.e., a-f)].
>
> I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.
>
> _____
> Signature
>
> _____
> Title
>
> _____
> Registration No., if applicable
>
> _____
> Address

The certification statements must be kept on file indefinitely at the tank facility, as specified in Sec. 264.192(g).

NATIONALLY ACCEPTED TANK DESIGN STANDARDS

Document Number	Title	Date
AA-ASD-1	Aluminum Standards and Data, 1970-71	1984
AA-ED-33	Engineering Data for Aluminum Structures	1981
AA-SAS-30	Specifications for Aluminum Structures	1982
ACI-344R-70	Design and Construction of Circular Prestressed Concrete Structures	1970
ACI-350R-77	Concrete Sanitary Engineering Structures	1983
AISI-PS-268-685-5M	Useful Information on the Design of Plate Structures	1985
AISI-TS-291-582-10M-NB	Steel Tanks for Liquid Storage	1982
ANSI B96.1	Standard for Welded Aluminum-Alloy Storage Tanks	1981
API 12B	Specification for Bolted Tanks for Storage of Production Liquids, 12th Ed.	1977
API 12D	Specification for Field Welded Tanks for Storage of Production Liquids, 8th Ed.	1982
API 12F	Specification for Shop Welded Tanks for Storage of Production Liquids, 7th Ed.	1982
API 620	Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks	1982
API 650	Welded Steel Tanks for Oil Storage	1984
ASME BPV-VIII-1	ASME Boiler and Pressure Vessel Code	1980
ASTM D 3299	Standard Specification for Filament-Wound Glass-Fiber Reinforced Thermoset Resin Chemical Resistant Tanks	1981
ASTM D 4021	Standard Specification for Glass-Fiber Reinforced Polyester Underground Petroleum Storage Tanks	1981

Continued on next page.

Document Number	Title	Date
AWWA-D100	Standard for Welded Steel Tanks for Water Storage	1984
NFPA 30	Flammable and Combustible Liquids Code	1984
UL 58	Standard for Steel Underground Tanks for Flammable and Combustible Liquids	1976
UL 80	Standard for Steel Inside Tanks for Oil Burner Fuel	1980
UL 142	Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids	1981
UL 1316	Standard for Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products	1983.

ORGANIZATIONS WITH UP-TO-DATE INFORMATION ON DESIGN STANDARDS

The Aluminum Association (AA)
818 Connecticut Avenue, N.W.
Washington, D.C. 20006
(202) 862-5100

American Petroleum Institute (API)
1220 L Street, N.W.
Washington, D.C. 20005
(202) 682-8000

American Concrete Institute (ACI)
22400 West Seven Mile Road
Detroit, MI 48219
(313) 532-2600

American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103
(215) 299-5400

American Iron and Steel Institute (AISI)
1000 Sixteenth Street, N.W.
Washington, D.C. 20036
(202) 452-7190

American Society of Mechanical Engineers (ASME)
Publications
22 Law Drive
Fairfield, NJ 07007
(201) 882-1167

American National Standards Institute, Inc. (ANSI)
1430 Broadway
New York, NY 10018
(212) 354-3300

American Water Works Association (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
(303) 794-7711

National Fire Protection Association (NFPA)
Batterymarch Park
Quincy, MA 02269
Publications: (800) 344-3555

Underwriters Laboratories, Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062
(312) 272-8800

COMPATIBILITY OF MATERIALS OF CONSTRUCTION WITH VARIOUS CHEMICALS

Material	Compatible With	Incompatible With
Minerals		
Sulfuric acid(1)	FRP(2) Mild Steel Rubber-lined	Concrete (10%)
Hydrochloric acid(3)	FRP	Mild steel concrete, including steel at 10%-37% hydrochloric acid
Nitric acid	FRP(4)	Mild steel concrete, with 2% and 40% Nitric acid
Phosphoric acid	FRP Concrete--slow disintegration at 10% phosphoric acid	Mild steel
Organic Acids		
Acetic acid	FRP	Mild steel
Bases		
Sodium hydroxide	FRP Mild steel(5) Concrete (10%)	Mild steel(5)
Ammonium hydroxide	Mild steel(5) FRP(6) Concrete	Mild steel(5)

Sources: "Permit Writer's Guidance Manual for Hazardous Waste Tanks", U.S. Environmental Protection Agency, EPA Contract 68-01-6515 (undated draft), pp. B-5 through B-8.

"Effects of Substances on Concrete and Guide to Protective Treatments," Portland Cement Association (1981), pp. 7-11.

Footnotes at end of table.

Continued on next page.

Material	Compatible With	Incompatible With
Aqueous Salts		
Calcium chloride	FRP Concrete (If concrete is alternately wet and dry with the solution, then calcium chloride can induce slow disintegration).	Mild steel[7]
Sodium sulfate	FRP Concrete--disintegration of concrete with inadequate sulfate resistance. Concrete products cured in high-pressure steam are highly resistant to sulfates.	Mild steel
Copper sulfate	FRP Concrete--slow distintegration	Mild steel
Ferric chloride	FRP Concrete--slow disintegration	Mild steel
Sodium hypochloride	Special metal alloys	Mild steel
Stannous chloride	Noble metals Stainless steel to 50%	FRP
Sodium chloride	FRP Concrete--unless concrete is alternately wet and dry with the solution.	Mild steel

Footnotes at end of table.

Continued on next page.

Material	Compatible With	Incompatible With
Aqueous Salts (Continued)		
Alum	FRP Concrete--disintegration of concrete with inadequate sulfate resistance. Concrete products cured in high-pressure steam are highly resistant to sulfates.	Mild steel
Solvents		
Perchloroethylene	FRP[8] Concrete[9]	Mild steel
Carbon tetrachloride	FRP[10] Concrete[9]	Mild steel
Ethyl alcohol (11)	Mild steel, Stainless steel, Concrete	
Methyl ethyl ketone	FRP[12] Concrete	Mild steel [13]
Acetone	FRP[14] Concrete; however, acetone may contain acetic acid as impurity.	Mild steel[15]
Miscellaneous		
Benzene	FRP[16] Concrete	Mild steel
Hexane	Mild steel[17]	FRP
Aniline	Stainless steel[18]	FRP Mild steel

Footnotes at end of table.

Continued on next page.

Material	Compatible With	Incompatible With
Miscellaneous (Continued)		
Nitrobenzene	FRP(19) Mild steel	FRP
Phenol	Mild steel Stainless steel Concrete--slow disintegration	
Chlorobenzene	Mild steel Stainless steel	
Naphthalene	Mild steel(20)	FRP(21)
Benzoic acid	Special metals (nickel-base alloys)	Mild steel
Diethyl amine	Mild steel(22)	
Formaldehyde	FRP Stainless steel Concrete--Slow disintegration due to formic acid formed in solution	Mild steel

NOTES:

(1) Needs the attention of a corrosion specialist. FRP is good up to 70% concentration. Mild steel (M.S.) is good for concentrations from 93% to 98%.

(2) Fiberglass-reinforced plastics (FRP) have been considered here. However, there are fiberglass-reinforced epoxy resins available that are not considered in this table.

Continued on next page.

NOTES:

(3) FRP is good to 30% concentration. No organic solvents should be present. The National Association of Corrosion Engineers (NACE), Houston, TX, has a graph for the compatibility of various metals for HCl use.

(4) FRP is good to 15% concentration.

(5) M.S. is good only to 25°C. 316 stainless steel (S.S.) is recommended for service conditions about 25°C.

(6) FRP is good to about 50% concentration.

(7) M.S. is incompatible after about 5% concentration at 100°C.

(8) FRP is good to about 25°C.

(9) Impervious concrete is required to prevent loss from penetration, and surface treatments are generally used.

(10) FRP is good to about 125°C.

(11) FRP is good for 95% concentration and 21° to 66°C.

(12) FRP is good from 10° to 35°C.

(13) M.S. is incompatible for concentrations below 100%.

(14) FRP is good for 10% concentration and 21° to 79.5°C.

(15) M.S. is incompatible for concentrations below 100%.

(16) FRP is good from 10° to 32°C.

(17) M.S. is good for 100% solvent to 100°C.

(18) S.S. is good to 100% concentration.

(19) FRP is good for 5% concentration and 21° to 52°C.

(20) M.S. is good to 100% concentration.

(21) FRP is good for only 100% concentration and 21° to 27°C; therefore, it is listed as incompatible.

(22) M.S. is good only at 100% concentration and up to 100°C.

COATING/LINING VS. CHEMICALS

Coating/Lining Material	Generally Incompatible With
Alkyds	Strong mineral acids, strong alkalies, alcohol, ketones, esters, aromatic hydrocarbons
Chlorinated rubbers	Organic solvents
Coal tar epoxy	Strong organic solvents
Epoxy (amine cured, polyamide cured, or esters)	Oxidizing acids (nitric acid), ketones
Polyesters	Oxidizing acids, strong alkalies, mineral acids, ketones, aromatic hydrocarbons
Silicones	Strong mineral acids, strong alkalies, alcohols, ketones, aromatic hydrocarbons
Vinyls (polyvinyl chloride-PVC)	Ketones, esters, aromatic hydrocarbons

Source: New York State Department of Environmental Conservation, "Technology for the Storage of Hazardous Liquids--A State-of-the-Art Review" (January 1983), p. 36.

GENERAL CHARACTERISTICS OF IMPERMEABLE BARRIERS FOR CONCRETE VAULTS

Severity Of Chemical Environment	Total Nominal Thickness Range	Typical Protective Barrier Systems	Typical Uses
Mild	Under 40 mil (1 mm)	Polyvinyl butyral, polyurethane, epoxy, acrylic, chlorinated rubber, styrene-acrylic copolymer. Asphalt, coal tar, chlorinated rubber, epoxy, polyurethane, vinyl, neoprene, coal tar epoxy, coal tar urethane.	o Protection against deicing salts. o Improve freeze-thaw resistance. o Prevent staining of concrete. o Use for high-purity water service. o Protect concrete in contact with chemical solutions having a pH as low as 4, depending on the chemical.
Intermediate	125 to 375 mil (3 to 9 mm)	Sand-filled epoxy, sand-filled polyester, sand filled polyurethane, bituminous materials.	o Protect concrete from abrasion and intermittent exposure to dilute acids in chemical, dairy, and food processing plants.
Severe	20 to 250 mil (1/2 to 6 mm)	Glass-reinforced epoxy, glass-reinforced polyester, precured neoprene sheet, plasticized PVC sheet.	o Protect concrete tanks and floors during continuous or intermittent immersion, exposure to water, dilute acids, strong alkalies, and salt solutions.

Source: American Concrete Institute, "A Guide to the Use of Waterproofing, Dampproofing, Protective and Decorative Barrier Systems for Concrete," 515.1R-79, (1984), p. 29.

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Continued on next page

Severity Of Chemical Environment	Total Nominal Thickness Range	Typical Protective Barrier Systems	Typical Uses
Severe	20 to 280 mil	Composite systems: a) Sand-filled epoxy system topcoated with a pigminted but unfilled epoxy; and	o Protect concrete tanks during continuous or intermittent immersion, exposure to water, dilute acids, strong alkalies, and salt solutions.
		b) Asphalt membrane* covered with acid-proof brick using a chemical resistant mortar.	o Protect concrete from concentrated acids or acid/solvent combinations.

* Other membranes may be used depending on chemical environment.

CHECKLIST FOR TANK INTERNAL INSPECTION
(Tank Out of Service)

Solid Steel Tanks

(1) Roof and Structural Supports (visual first for safety)
- -- no hazards of falling objects
- -- corrosion

(2) Roof and Structural Supports (more rigorous)
- -- loss of metal thickness
- -- cracks, leaks at welds
- -- cracks at nozzle connections
- -- malfunctioning of floating roof seals
- -- water drain system deterioration
- -- hammer testing, if necessary

(3) Tank Shell
- -- cracks at seams
- -- corrosion of vapor space and liquid-level line
- -- cracking of plate joints
- -- cracking of nozzle connection joints
- -- loss of metal thickness

(4) Tank Bottom
- -- corrosion pits
- -- cracked seams
- -- rivets for tightness and corrosion
- -- depressions in bottom areas around or under roof and pipe supports
- -- bottom thickness
- -- uneveness of bottom
- -- hammer testing and bottom sampling, if necessary
- -- general condition of liner (holes, cracks, gaps, corrosion, erosion, swelling, hardness, loss of thickness)
- -- bulges, blistering, or spalling
- -- spark testing of rubber, glass, and organic type coatings
- -- ultrasonic examination of steel outer shell thickness, if possible, if any deterioration is suspected.

Source: "Permit Writer's Guidance Manual for Hazardous Waste Tanks," U.S. Environmental Protection Agency, EPA Contract 68-01-6515 (undated draft), pp. 8-10 and 8-11.

Continued on next page.

Lined Steel Tanks*

(1) General condition of lining
--holes
--cracks
--gaps
--corrosion
--swelling
--hardness
--loss of thickness

(2) Proper positioning of liner

Fiberglass-reinforced-plastic Tanks

- softening, identations, cracks, exposed fibers, crazing, checking, lack of surface resin, and delamination
- sufficiently translucent, discolored, porous, air or other bubbles visible, other inclusions, and thin areas
- hardness testing of specimens exposed to liquid contents
- ultrasonic examination of laminate thickness, if possible, if any deterioration is suspected in the polyester matrix.

*Tanks may be lined with alloy steel, lead, rubber, glass, coatings, or concrete. The inspection procedures and locations noted for solid steel tanks are equally applicable to lined tanks.

COMPARISON OF VARIOUS LEAK-SENSING TECHNIQUES

Sensor	Applications	Advantages/Disadvantages
Thermal-Conductivity Sensors	Can monitor liquids in soils	Primary advantage is early detection, which makes it possible for leaks and spills to be corrected before large volumes of material are discharged.
Electrical-Resistivity Sensors	Can monitor liquids in soils	Primary advantage is the early detection of spills. Once a leak or spill is detected, the sensors must be replaced. Can detect small and large leaks.
Vapor Detectors	Monitors vapor in areas of highly permeable, dry soil, such as excavation backfill or other permeable soils	Very useful for quick detection of highly volatile wastes.
Interstitial Monitoring in Double-Walled Tanks	Measures changes of pressure or the interstitial presence of liquids in double-walled tanks	Accurate technique which is applicable to all double-walled tanks.

SOURCE: New York State Department of Environmental Conservation, "Technology for the Storage of Hazardous Liquids--A State-of-the-Art Review" (January 1983), p. 92.

LIST OF CHEMICAL CLASSES

Chemical Class Number	Class Name
1	Acids, mineral, non-oxidizing
2	Acids, mineral, oxidizing
3	Acids, organic
4	Alcohols and glycols
5	Aldehydes
6	Amides
7	Amines, aliphatic and aromatic
8	Azo compounds, diazo compounds and hydrazines
9	Carbamates
10	Caustics
11	Cyanides
12	Dithiocarbamates
13	Esters
14	Ethers
15	Fluorides, inorganic
16	Hydrocarbons, aromatic
17	Halogenated organics
18	Isocyanates
19	Ketones
20	Mercaptans and other organic sulfides
21	Metal compounds, inorganic
22	Nitrides
23	Nitrites
24	Nitro compounds
25	Hydrocarbons, aliphatic, unsaturated
26	Hydrocarbons, aliphatic, saturated
27	Peroxides and hydroperoxides, organic
28	Phenols and cresols
29	Organophosphates, phosphothioates, and phosphodithioates
30	Sulfides, inorganic
31	Epoxides
32	Combustible and flammable materials
33	Explosives
34	Polymerizable compounds
35	Oxidizing agents, strong
36	Reducing agents, strong
37	Water and mixtures containing water
38	Water reactive substances

Source: "A Method for Determining the Compatibility of Hazardous Wastes" (Hatayama et al., 1980).

LIST OF CHEMICAL REPRESENTATIVES BY CLASS

Class 1 Acids, mineral, non-oxidizing

- Boric Acid
- Chlorosulfonic Acid
- Hydriodic Acid
- Hydrobromic Acid
- Hydrochloric Acid
- Hydrocyanic Acid
- Hydrofluoric Acid
- Hydroidic Acid
- Phosphoric Acid

Class 2 Acids, mineral, oxidizing

- Chloric Acid
- Chromic Acid
- Nitric Acid
- Oleum
- Perchloric Acid
- Sulfuric Acid
- Sulfur Trioxide

Class 3 Acids, organic (All Isomers)

- Acetic Acid
- Benzoic Acid
- Formic Acid
- Lactic Acid
- Maleic Acid
- Oleic Acid
- Salycilic Acid
- Phthalic Acid

Class 4 Alcohols and glycols (All Isomers)

- Allyl Alcohol
- Chlorethanol
- Cyclohexanol
- Ethanol
- Ethylene Chlorohydrin
- Ethylene Glycol
- Ethylene Glycol Monomethyl Ether
- Glycerin
- Methanol
- Monoethanol Amine

Class 5 Aldehydes (All Isomers)

- Acetaldehyde
- Formaldehyde
- Furfural

Class 6 Amides (All Isomers)

- Acetamide
- Diethylamide
- Dimethylformamide

Class 7 Amines, aliphatic and aromatic (All Isomers)

- Aminoethanol
- Aniline
- Diethylamine
- Diamine
- Ethylenendiamine
- Methylamine
- Monoethylanolamine
- Pyridine

Class 8 Azo compounds, diazo compounds and hydrazines

- Dimethyl Hydrazine
- Hydrazine

Class 9 Carbamates

Class 10 Caustics

- Ammonia
- Ammonium Hydroxide
- Calcium Hydroxide
- Sodium Carbonate
- Sodium Hydroxide
- Sodium Hypochlorite

Class 11 Cyanides

- Hydrocyanic Acid
- Potassium Cyanide
- Sodium Cyanide

Continued on next page.

Class 12 Dithiocarbamates

Class 13 Esters (All Isomers)

- Butyl Acetate
- Ethyl Acetate
- Methyl Acrylate
- Methyl Formate
- Dimethyl Phthalate
- Propiolaetone

Class 14 Ethers (All Isomers)

- Dichloroethyl Ether
- Dioxane
- Ethylene Glycol Monomethyl Ether
- Furan
- Tetrahydrofuran

Class 15 Fluorides, inorganic

- Aluminum Fluoride
- Ammonium Fluoride
- Fluorosilicic Acid
- Flucsilic Acid
- Hydrofluorosilicic Acid

Class 16 Hydrocarbons, aromatic (All Isomers)

- Benzene
- Cumene
- Ethyl Benzene
- Naphthalene
- Styrene
- Toluene
- Xylene

Class 17 Halogenated organics (All Isomers)

- Aldrin
- Benzyl Chloride
- Carbon Tetrachloride
- Chloroacetone
- Chlorobenzene

Class 17 Halogenated organics (All Isomers) (Continued)

- Chlorocresol
- Chloroethanol
- Chloroform
- Dichloroacetone
- Dichloroethylether
- Dichloromethane (Methylene Dichloride)
- Epichlorohydrin
- Ethylene Chlorohydrin
- Ethylene Dichloride
- Freons
- Methylchloride
- Pentachlorophenol
- Tetrachloroethane
- Trichloroethylene

Class 18 Isocyanates (All Isomers)

Class 19 Ketones (All Isomers)

- Acetone
- Acetophenone
- Cyclohexanone
- Dimethyl Ketone
- Methyl Ethyl Ketone
- Methyl Isobutyl Ketone
- Quinone (Benzoquinone)

Class 20 Mercaptans and other organic sulfides (All Isomers)

- Carbon Disulfide
- Ethyl Mercaptan

Class 21 Metal compounds, inorganic

- Aluminum Sulfate
- Chromic Acid
- Silver Nitrate
- Tetraethyl Lead
- Zinc Chloride

Continued on next page.

Class 22 Nitrides

Class 23 Nitrites

Acrylonitrile

Class 24 Nitro compounds (All Isomers)

Nitrobenzene
Nitrophenol
Nitropropane
Nitrotoluene
Picric Acid

Class 25 Hydrocarbons, aliphatic, unsaturated (All Isomers)

Butadiene
Styrene

Class 26 Hydrocarbons, aliphatic, saturated

Butane
Cyclohexane

Class 27 Peroxides and hydroperoxides, organic

Benzoyl Peroxide
Hydrogen Peroxide
Chlorocresol
Coal Tar
Cresol
Creosote

Class 28 Phenols and cresols

Hydroquinone
Nitrophenol
Phenol
Picric Acid
Resorcinol

Class 29 Organophosphates, phosphothioates, and phosphodithioates

Malathion
Parathion

Class 30 Sulfides, inorganic

Class 31 Epoxides

Epichlorohydrin

Class 32 Combustible and flammable materials

Diesel Oil
Gasoline
Kerosene
Naphtha
Turpentine

Class 33 Explosives

Benzoyl Peroxide
Picric Acid

Class 34 Polymerizable compounds

Acrylonitrile
Butadiene
Methyl Acrylate
Styrene

Class 35 Oxidizing agents, strong

Chloric Acid
Chromic Acid
Silver Nitrate
Sodium Hypochlorite
Sulfur Trioxide

Class 36 Reducing agents, strong

Diamine
Hydrazine

Continued on next page.

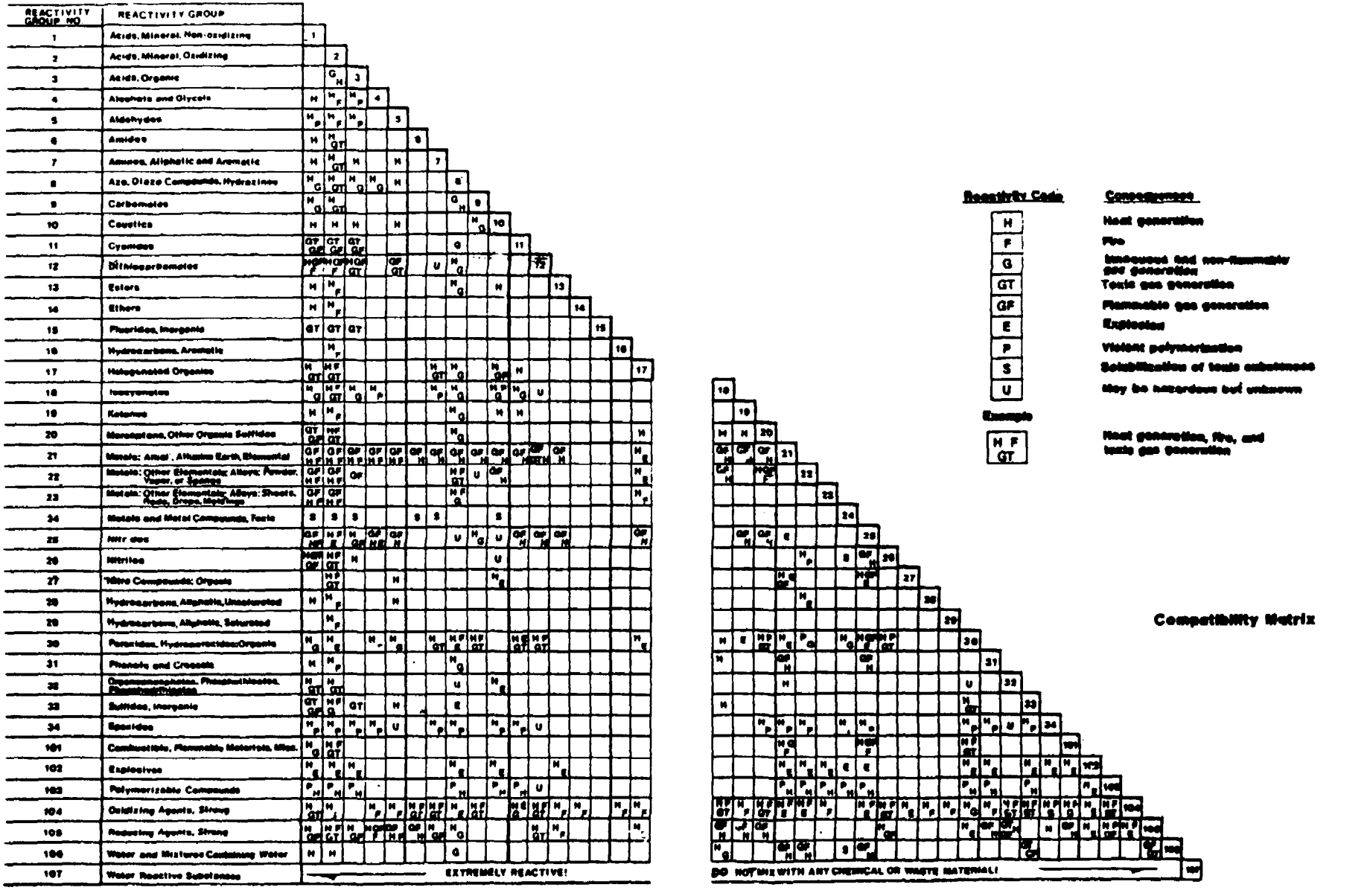
Class 37 Water and mixtures containing water

Aqueous solutions and mixtures
Water

Class 38 Water reactive substances

Acetic Anhydride
Hydrobromic Acid
Sulfuric Acid
Sulfur Trioxide

SOURCE: "A Method for Determining the Compatibility of Hazardous Wastes" (Hatayama et al., 1980).


REACTIVITY GROUP NO
REACTIVITY GROUP
1 Acids, Mineral, Non-oxidizing
2 Acids, Mineral, Oxidizing
3 Acids, Organic
4 Alcohols and Glycols
5 Aldehydes
6 Amides
7 Amines, Aliphatic and Aromatic
8 Azo, Diazo Compounds, Hydrazines
9 Carbamates
10 Caustics
11 Cyanides
12 Dithiocarbamates
13 Esters
14 Ethers
15 Fluorides, Inorganic
16 Hydrocarbons, Aromatic
17 Halogenated Organics
18 Isocyanates
19 Ketones
20 Mercaptans, Other Organic Sulfides
21 Metals: Alkali, Alkaline Earth, Elemental
22 Metals: Other Elemental & Alloys: Powder, Vapor, or Sponge
23 Metals: Other Elemental & Alloys: Sheets, Rods, Drops, Machined
24 Metals and Metal Compounds, Toxic
25 Nitro Compounds
26 Nitriles
27 Nitro Compounds: Organic
28 Hydrocarbons, Aliphatic, Unsaturated
29 Hydrocarbons, Aliphatic, Saturated
30 Peroxides, Hydroperoxides: Organic
31 Phenols and Cresols
32 Organophosphates, Phosphothioates, Phosphodithioates
33 Sulfides, Inorganic
34 Epoxides
101 Combustible, Flammable Materials, Misc.
102 Explosives
103 Polymerizable Compounds
104 Oxidizing Agents, Strong
105 Reducing Agents, Strong
106 Water and Mixtures Containing Water
107 Water Reactive Substances
EXTREMELY REACTIVE!
Reactivity Code
H
F
G
GT
GF
E
P
S
U
Consequences
Heat generation
Fire
Innocuous and non-flammable gas generation
Toxic gas generation
Flammable gas generation
Explosion
Violent polymerization
Solubilization of toxic substances
May be hazardous but unknown
Example
H F GT
Heat generation, fire, and toxic gas generation
Compatibility Matrix
DO NOT MIX WITH ANY CHEMICAL OR WASTE MATERIAL!

STABLE LIQUIDS--OPERATING PRESSURE 2.5 PSIG or LESS

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way, and Shall Not Be Less Than 5 Feet	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property and Shall Not Be Less Than 5 Feet
Floating Roof[1]	Protection for Exposure[2]	1/2 times diameter of tank	1/2 times diameter of tank
	None	Diameter of tank but need not exceed 175 ft.	1/2 times diameter of tank
Vertical with Weak Roof to Shell Seam[3]	Approved foam or inerting system[4] on tanks not exceeding 150 ft. in diameter[5]	1/2 times diameter of tank	1/2 times diameter of tank
	Protection for Exposures[2]	Diameter of tank	1/2 times diameter of tank
	None	2 times diameter of tank but need not exceed 350 ft.	1/2 times diameter of tank
Horizontal and Vertical with Emergency Relief Venting to Limit Pressures to 2.5 psig	Approved inerting system[4] on the tank or approved foam system on vertical tanks	1/2 times Table 13-7	1/2 times Table 13-7
	Protection for Exposures[2]	Table 13-7	Table 13-7
	None	2 times Table 13-7	Table 13-7

Footnotes and source on following page.

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1 Aboveground tank which incorporates either: (1) a pontoon or double deck metal floating roof in an open top tank in accordance with API Standard 650; or (2) a fixed metal roof with ventilation at the top and roof eaves in accordance with API Standard 650 and containing a metal floating roof or cover meeting the requirements of (1) or a metal floating cover supported by liquid-tight metal pontoons or floats capable of providing sufficient buoyancy to prevent sinking of the cover when half of the pontoons or floats are punctured.

2 Fire protection for structure on property adjacent to liquid storage shall be acceptable when located: (1) within the jurisdiction of any public fire department; or (2) adjacent to plants having private fire brigades capable of providing cooling water streams on structures on property adjacent to liquid storage.

3 Aboveground storage tank with some form of construction or device that will relieve excessive internal pressure caused by fires. Construction shall take the form of a weak roof-to-shelf seam to fail preferential to any other seam.

4 See NFPA 69, Explosion Prevention Systems.

5 For tanks over 150 feet in diameter, use "Protection for Exposures" or "None" as applicable.

SOURCE: Table 2-1, "(NFPA) 30: Flammable and Combustible Liquids Code 1984."

SI Units: 1 foot = 0.30 meters.

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
STABLE LIQUIDS--OPERATING PRESSURE GREATER THAN 2.5 PSIG			
ANY TYPE	Protection for Exposures[2]	1-1/2 times Table A but shall not be less than 25 feet	1-1/2 times Table 13-7 but shall not be less than 25 feet
	None	3 times Table A but shall not be less than 50 feet	1-1/2 times Table 13-7 but shall not be less than 25 feet
BOIL-OVER LIQUIDS			
Floating Roof[1]	Protection for Exposure[2]	1/2 times diameter of tank	1/6 times diameter of tank
	None	Diameter of tank	1/6 times diameter of tank
Fixed Roof	Approved Foam Or Inerting System[3]	Diameter of tank	1/3 times diameter of tank
	Protection for Exposure[2]	1/2 times diameter of tank	2/3 times diameter of tank
	None	Diameter of tank	2/3 times diameter of tank

1 See definition, footnote 1, page B-10b

2 Fire protection for structures on property adjacent to liquid storage shall be acceptable when located: (1) within the jurisdiction of any public fire department; or (2) adjacent to plants having private fire brigades capable of providing cooling water streams on structures on property adjacent to liquid storage.

3 See NFPA 69, "Explosion Prevention Systems."

Source: Table 2-3, "(NFPA) 30: Flammable and Combustible Liquids Code 1984."

Table 2-2, "(NFPA) 30: Flammable and Combustible Liquids Code 1984."

SI Units: 1 ft. = 0.30 m.

UNSTABLE LIQUIDS

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or From Nearest Important Building on the Same Property
Horizontal and Vertical Tanks with Emergency Relief Venting to Permit Pressure Not in Excess of 2.5 psig	Tank protected with any one of the following: approved water spray; approved inerting;[1] approved insulation and refrigeration; and approved barricade	page B-10e but not less than 25 feet	Not less than 25 feet
	Protection for Exposures[2]	2-1/2 times page B-10e but not less than 50 feet	Not less than 50 feet
	None	5 times page B-10e but not less than 100 feet	Not less than 100 feet
Horizontal and Vertical Tanks with Emergency Relief Venting to Permit Pressure Over 2.5 psig	Tank protected with any one of the following: approved water spray; approved inerting;[1] approved insulation and refrigeration; and approved barricade	2 times page B-10e but not less than 50 feet	Not less than 50 fee
	Protection for Exposures[2]	4 times page B-10e but not less than 100 feet	Not less than 100 feet
	None	8 times page B-10e but not less than 150 feet	Not less than 150 feet

1 See "NFPA 69, Explosion Prevention Systems."

2 Fire protection for structures on property adjacent to liquid storage shall be acceptable when located: (1) within the jurisdiction of any public fire department; or (2) adjacent to plants having private fire brigades capable of providing cooling water streams on structures on property adjacent to liquid storage.

SOURCE: Table 2-4, "(NFPA) 30: Flammable and Combustible Liquids Code 1984."

Reference Table A

CLASS IIIB LIQUIDS

Capacity (Gallons)	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
12,000 or Less	5	5
12,001 to 30,000	10	5
30,001 to 50,000	10	10
50,001 to 100,000	15	10
100,001 or More	15	15

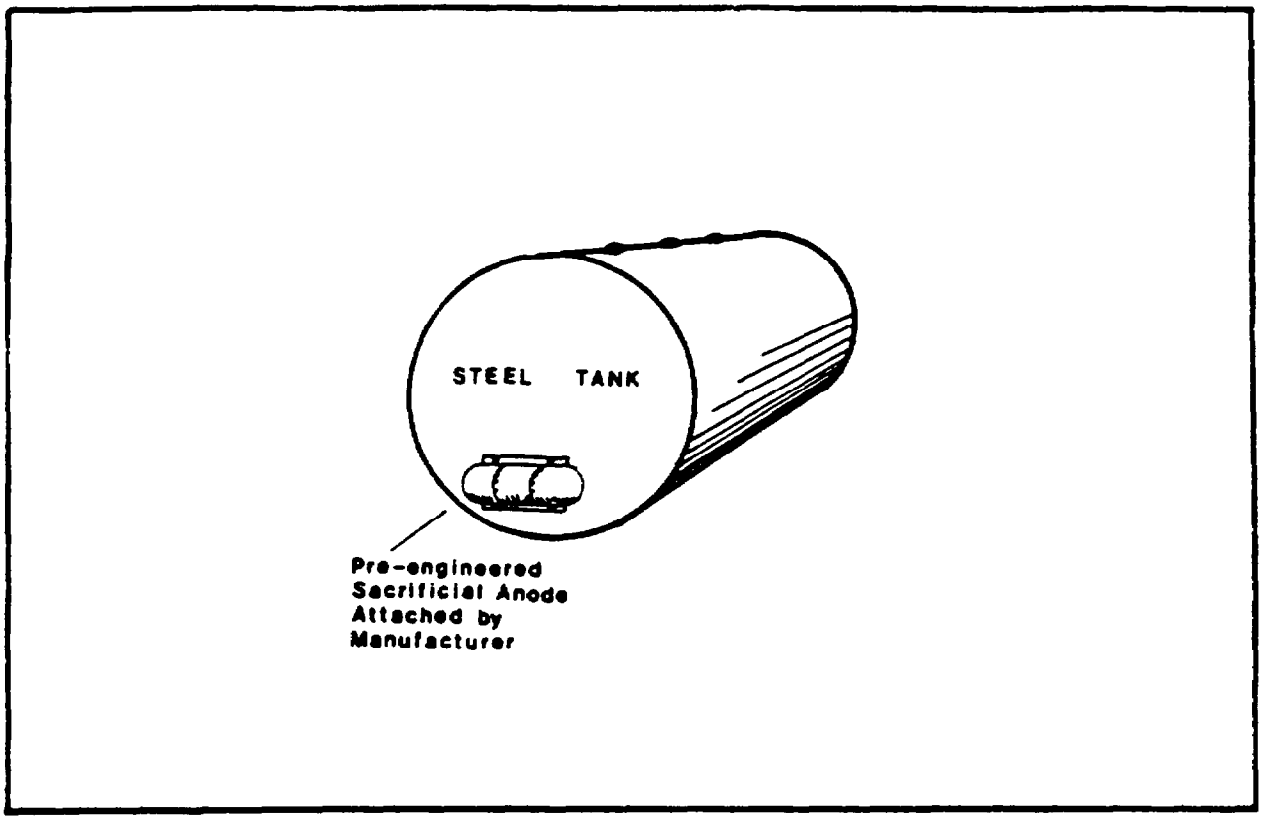
SI Units: 1 ft. = 0.3048 m; 1 gal. = 3.785 L.

Other Flammable or Combustible Liquids

Tank Capacity (Gallons)	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
275 or Less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or More	175	60

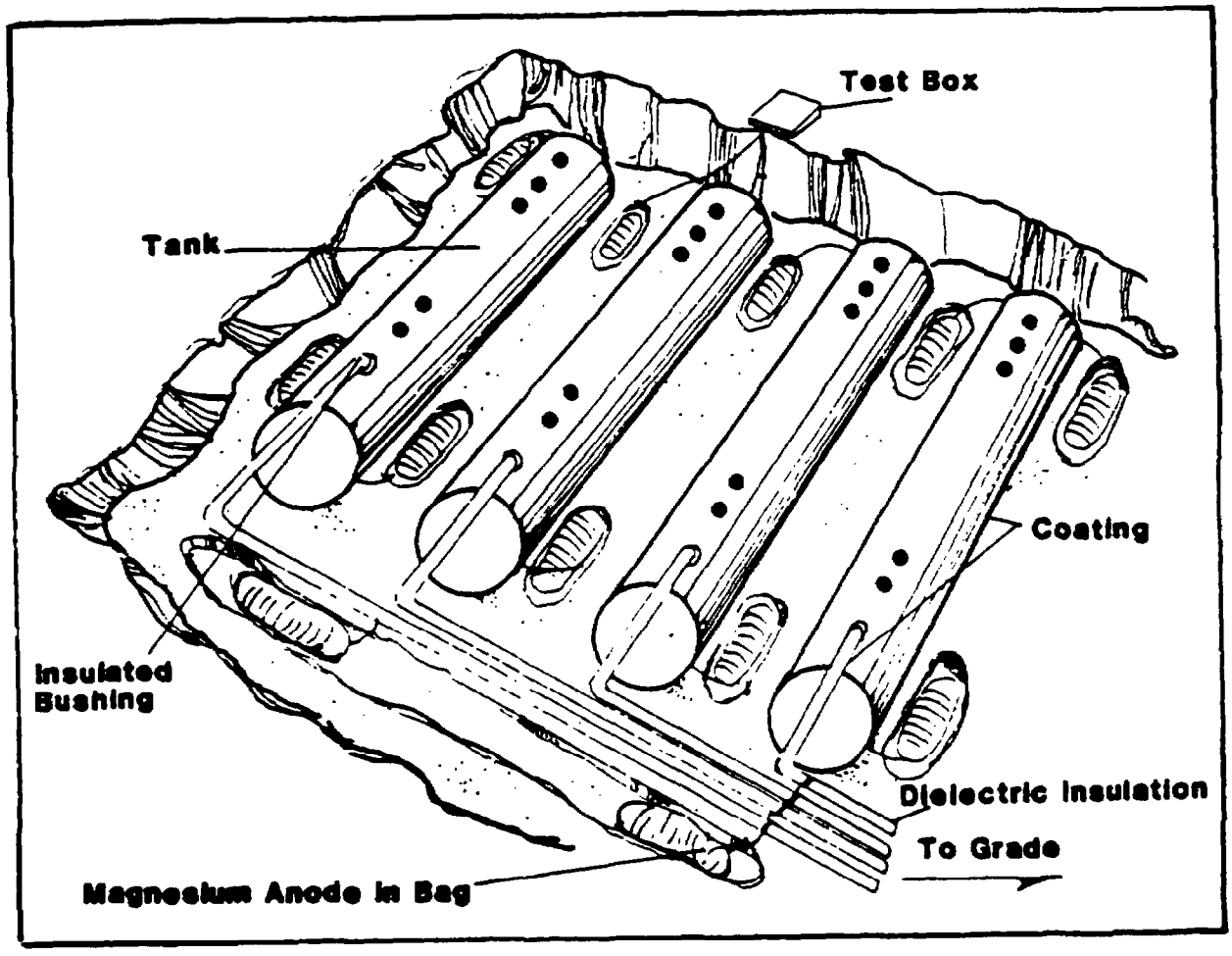
Source: Table 2-5, "(NFPA) 30: Flammable and Combustible Liquids Code 1984." Update of the 1977 and 1981 editions.

Factory Installed Sacrificial Anode



FIGURES ARE FOR ILLUSTRATIVE PURPOSES ONLY. THEY ARE NOT INTENDED FOR USE AS CONSTRUCTION DRAWINGS.

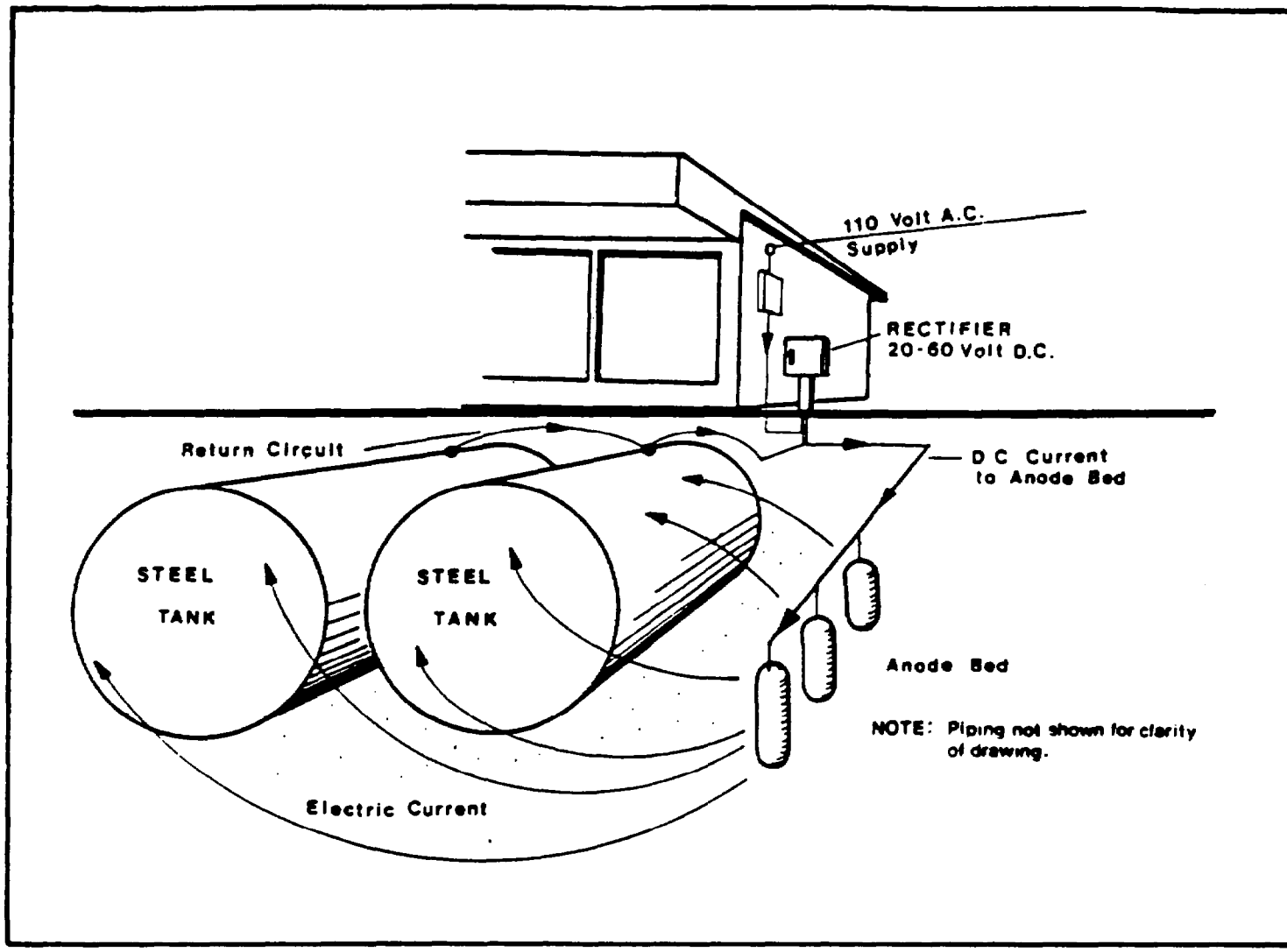
Sacrificial Anode Cathodic Protection



Source: Suggested Ways to Meet Corrosion Protection Codes for Underground Tanks and Piping, The Hinchman Company, Detroit, MI, 1981.

FIGURES ARE FOR ILLUSTRATIVE PURPOSES ONLY THEY ARE NOT INTENDED FOR USE AS CONSTRUCTION DRAWINGS.

Impressed Current Cathodic Protection



Source: Suggested Ways to Meet Corrosion Protection Codes for Underground Tanks and Piping, The Hinchman Company, Detroit, MI, 1981.

FIGURES ARE FOR ILLUSTRATIVE PURPOSES ONLY. THEY ARE NOT INTENDED FOR USE AS CONSTRUCTION DRAWINGS.

COMMON FORMS OF LOCALIZED CORROSION

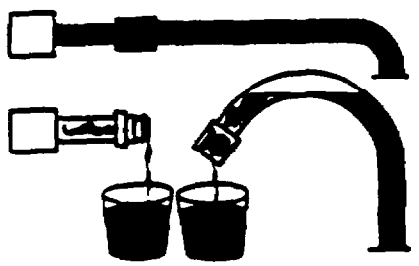
Type	Description
Bacterial corrosion	Soils or water that become oxygen-starved, i.e., anaerobic, cause this form of corrosion.
Contact or crevice corrosionbetween a metal and	Occurs at the point of contact or crevice a non-metal or between two metals.
Erosion corrosion	Moving fluid removes the protective surface film on a metal, allowing corrosion to occur.
Galvanic corrosion	Occurs when an electrolytic cell is formed in cases where dissimilar metals are electrically connected or where dissimilar soil conditions or differential aeration conditions exist.
Intergranular corrosion	Selective corrosion at the grain boundaries (microscopic) of a metal or alloy.
Pitting corrosion	Formation of shallow depressions or deep pits (cavities of small diameter).
Stray current corrosion	Occurs when direct electrical currents flow through metal.
Stress corrosion cracking	Corrosion accelerated by residual stresses resulting from fabrication operations or unequal heating and cooling of structure.

Source: New York State Department of Environmental Conservation, "Technology for the Storage of Hazardous Liquids--A State of the Art Review" (January 1983), pp. 11-17.

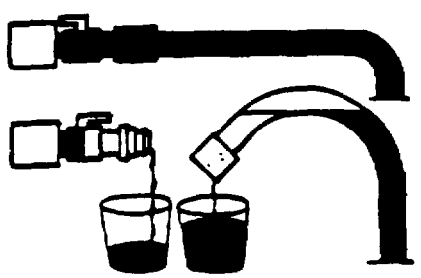
ENVIRONMENTS THAT CAN CAUSE CORROSION

Material	Environment
Aluminum	Water and steam; NaCl, including sea atmospheres and waters; air; water vapor.
Aluminum bronzes	Water and steam; H_2SO_4; caustics.
Austenitic stainless steels	Chlorides, including $FeCl_2$, $FeCl_3$, NaCl; sea environments; H_2SO_4; fluorides; condensing steam from chloride waters; acids.
Carbon and low alloy steels	HCl; caustics; nitrates; HNO_3; HCN; molten zinc and Na-Pb alloys; H_2S; H_2SO_4-HNO_3; H_2SO_4; seawater; water; distilled water.
Copper	Tropical atmospheres; mercury; $HgNO_3$; bromides; ammonia; ammoniated organics; acids.
Ferritic stainless steels	Chloride, including NaCl; fluorides; bromides; iodides; caustics; nitrates; distilled water; steam.
High strength alloy steels (yield strength 200 psi plus)	Sea and industrial environments; water.
Inconel	Caustic soda solutions; high purity water with few ppm oxygen.
Lead	Lead acetate solutions.
Magnesium	NaCl, including sea environments; water and steam; caustics; N_2O_4; rural and coastal atmospheres; distilled water.
Monel	Fused caustic soda; hydrochloric and hydrofluoric acids.
Nickel	Bromides; caustics; H_2SO_4.
Titanium	Sea environments; mercury; molten cadmium; silver and AgCl; methanols with halides; red fuming HNO_3; N_2O_4; chlorinated or fluorinated hydrocarbons.

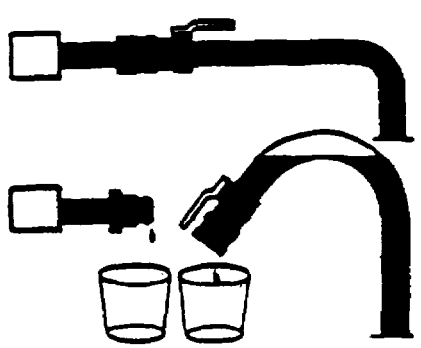
Source: Adapted from V.R. Pludek, Design and Corrosion-Control (New York, NY: John Wiley and Sons, 1977).



1. Ordinary Quick Disconnect



2. Quick Disconnect Plus Ball Valve



3. Dry Disconnect

Types of Couplings

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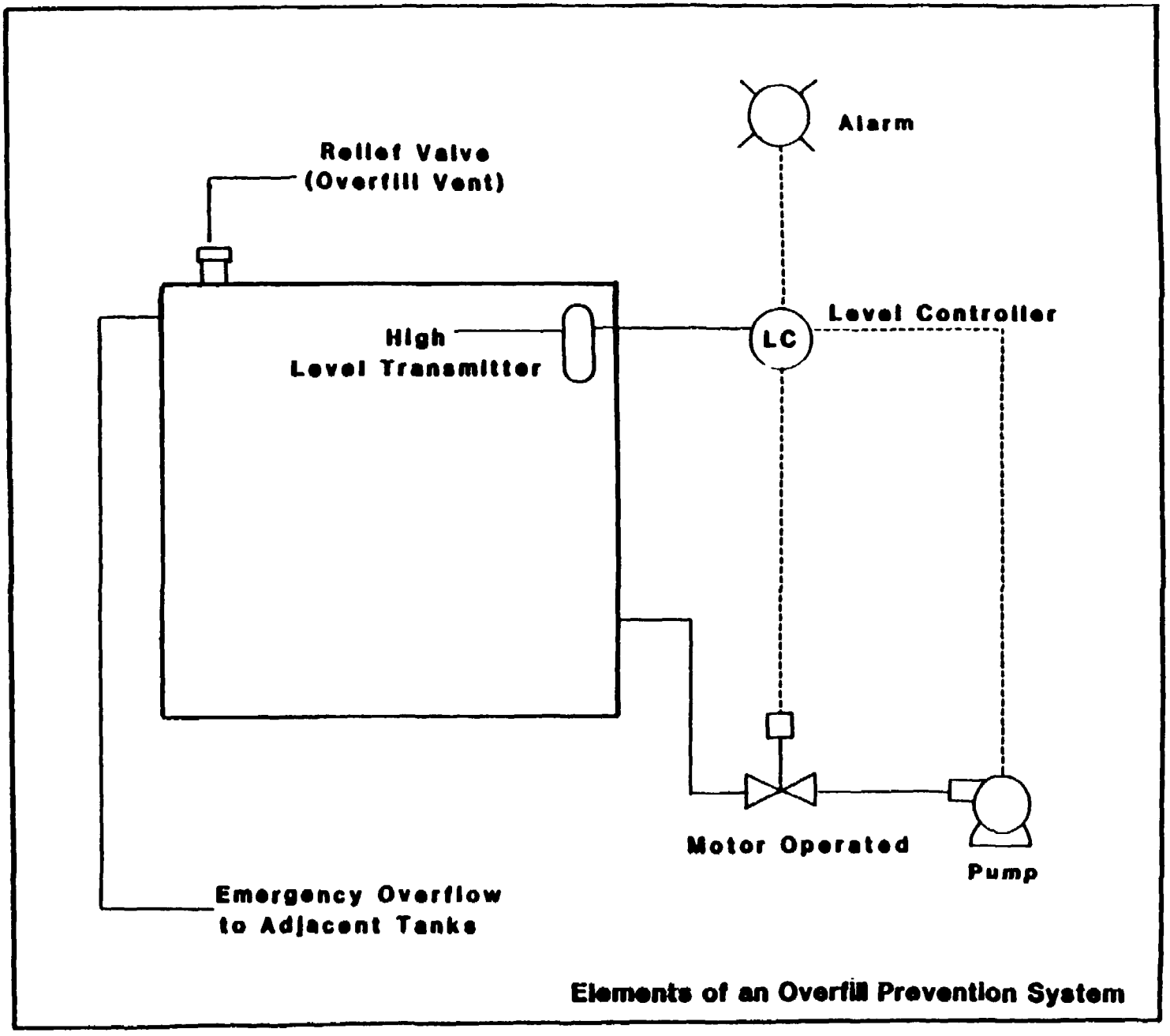

Elements of an Overfill Prevention System

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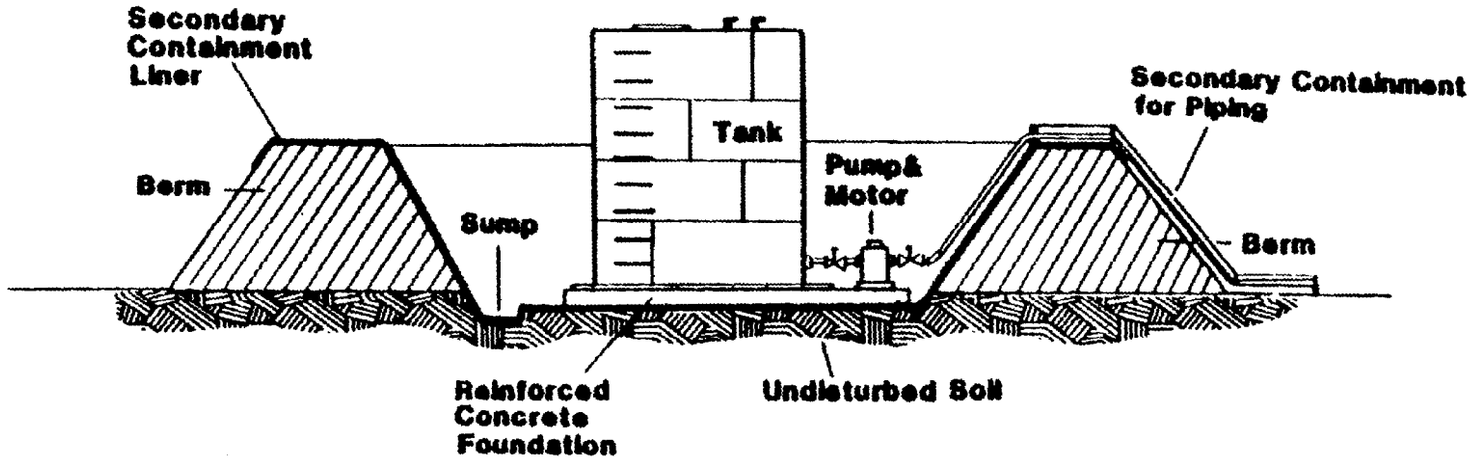

Note: Volume inside berms should be a minimum of 100% of the tank volume plus the precipitation from a 24 hour, 25 year storm

Aboveground Tank

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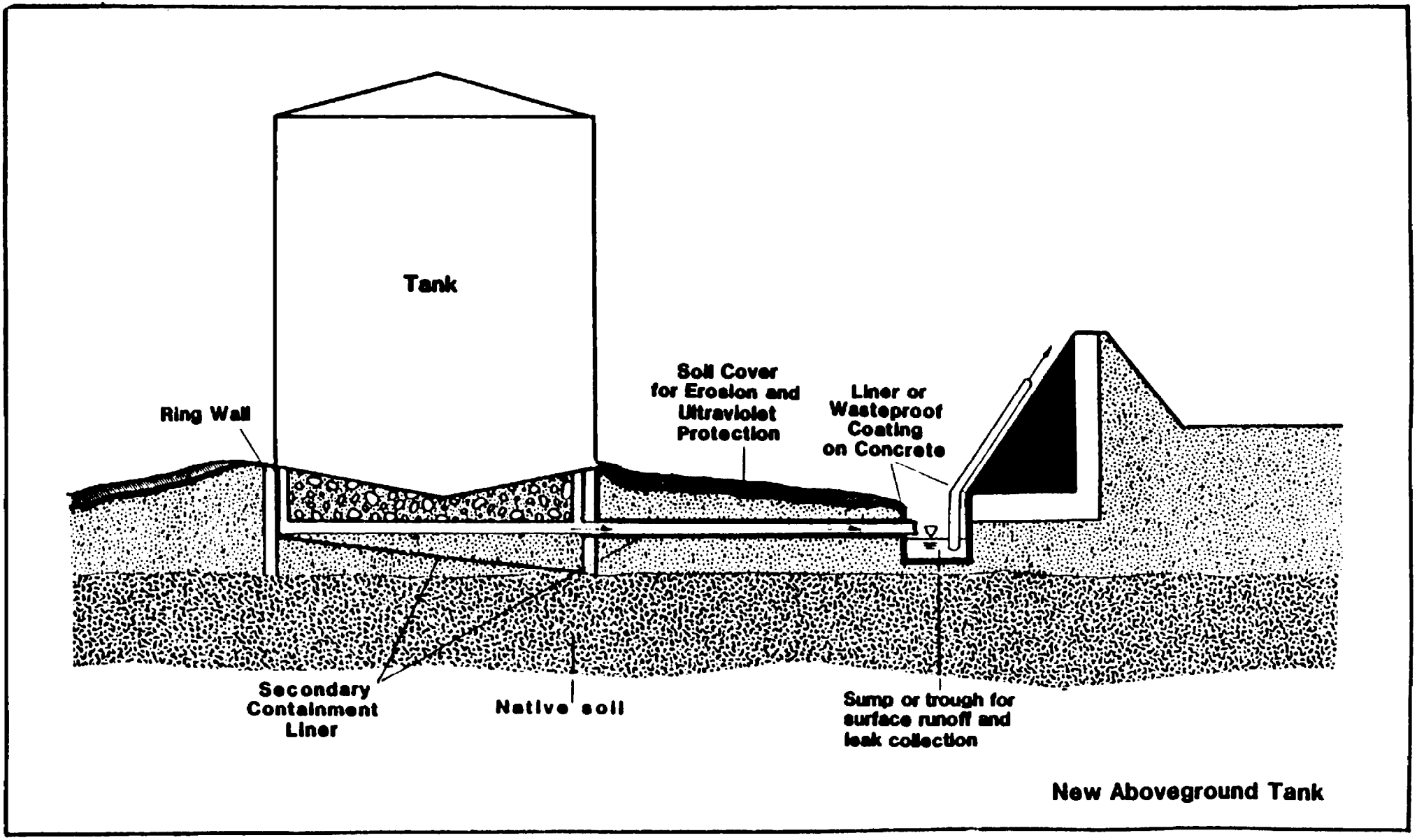

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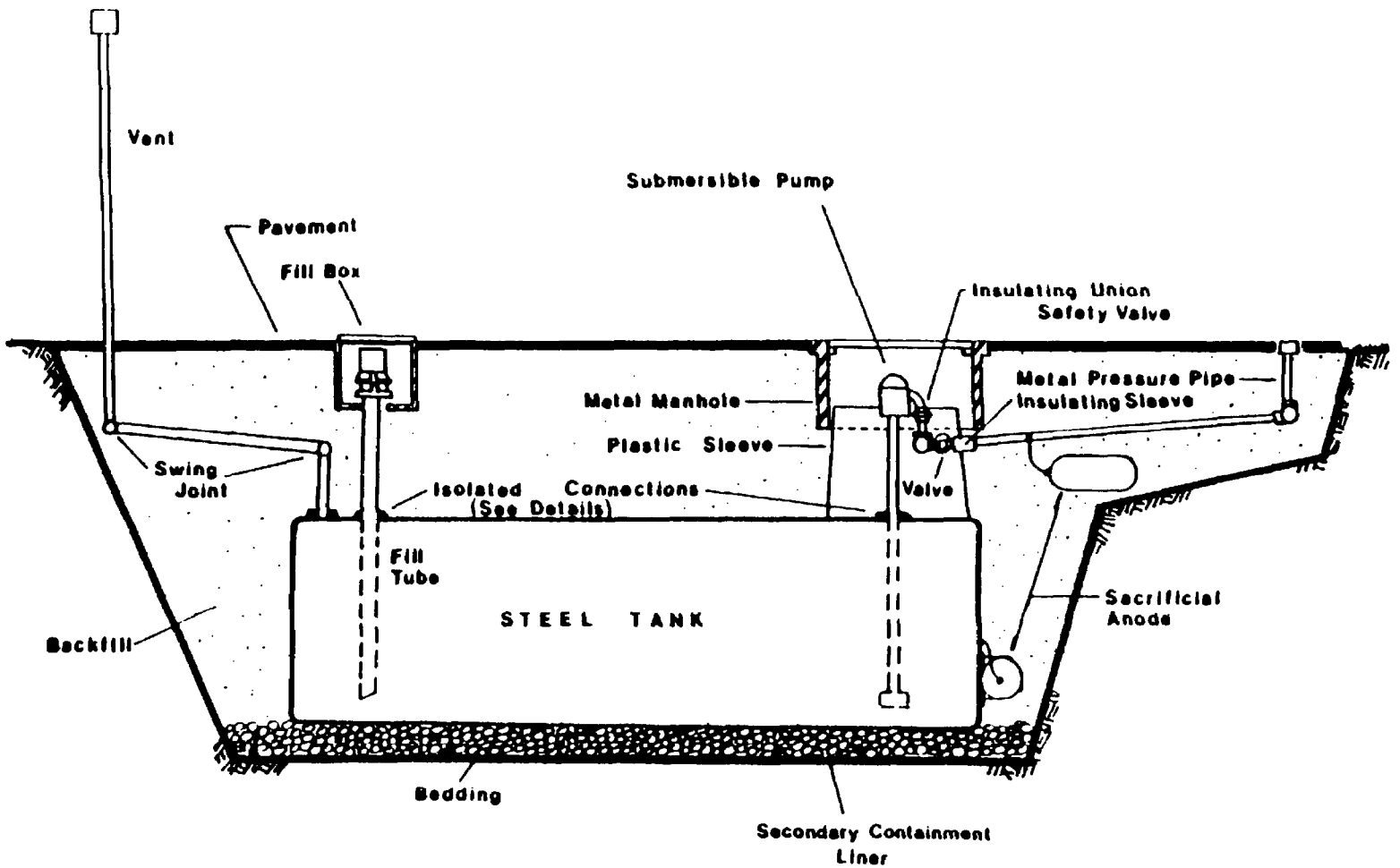
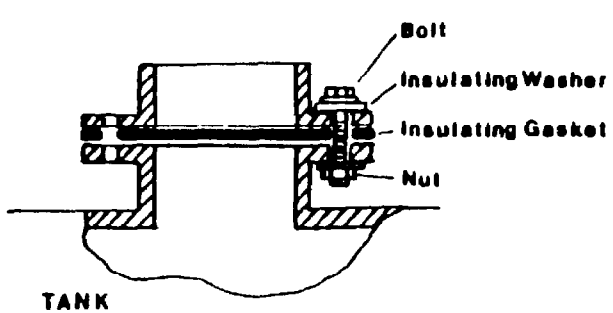
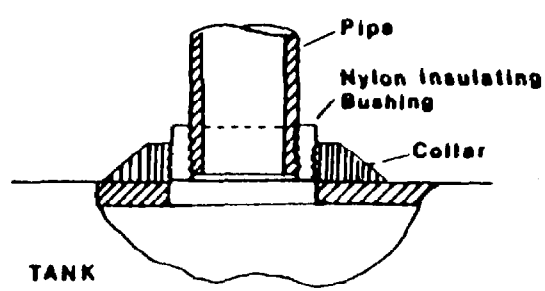


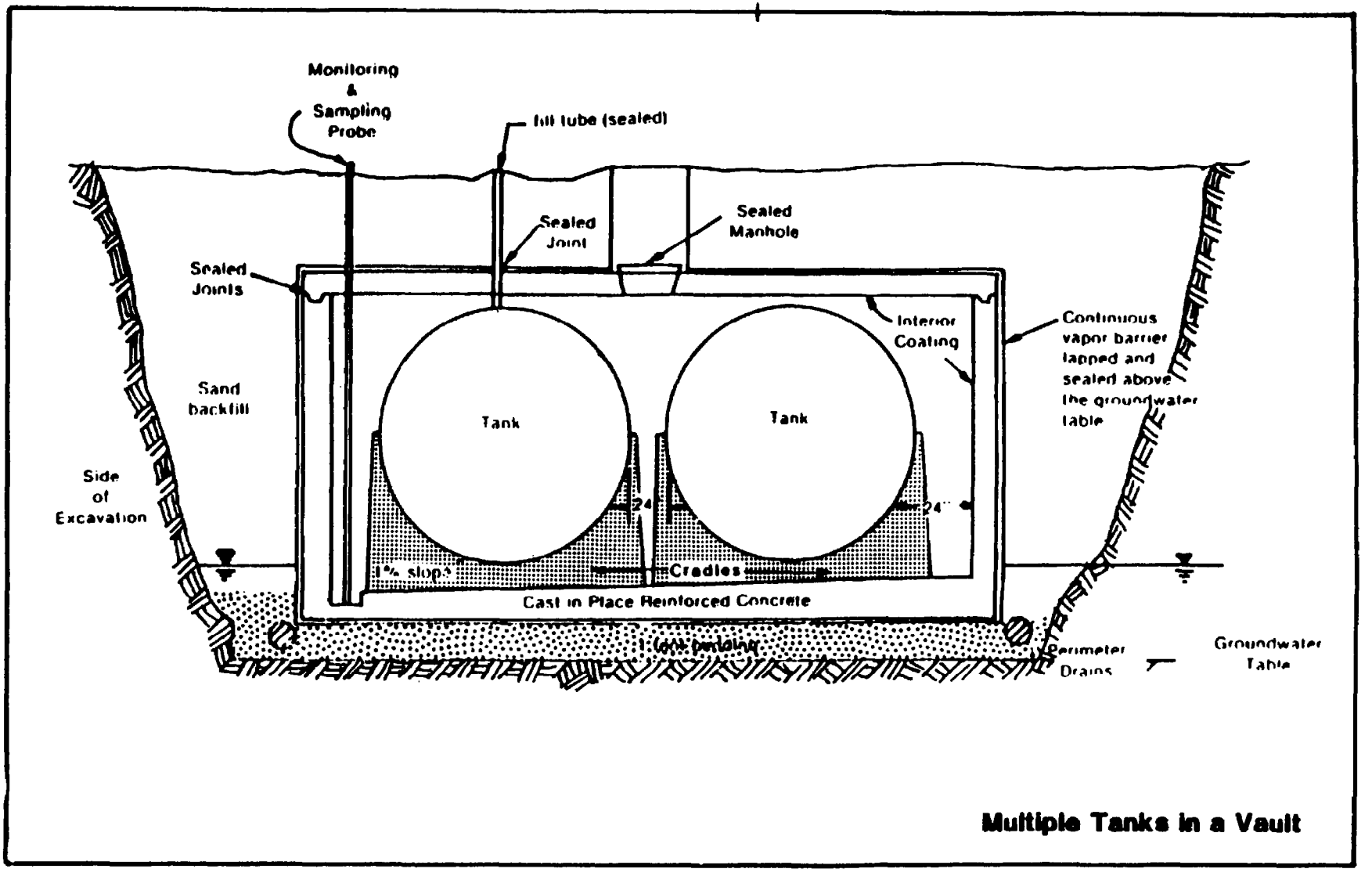


DETAIL - ISOLATED MECHANICAL CONNECTION



DETAIL - ISOLATED NYLON BUSHING CONNECTION

Underground Tank and Piping System



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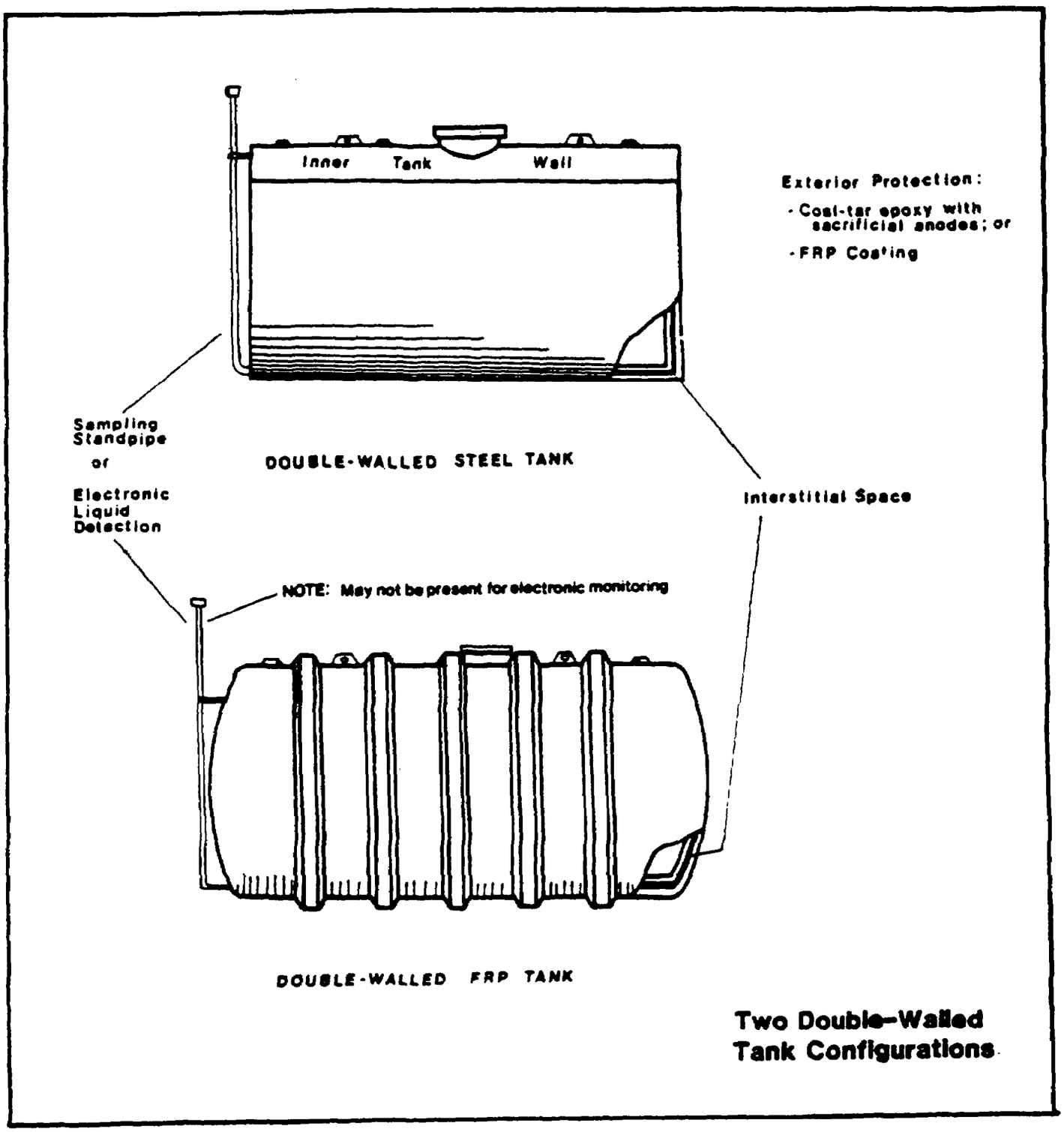

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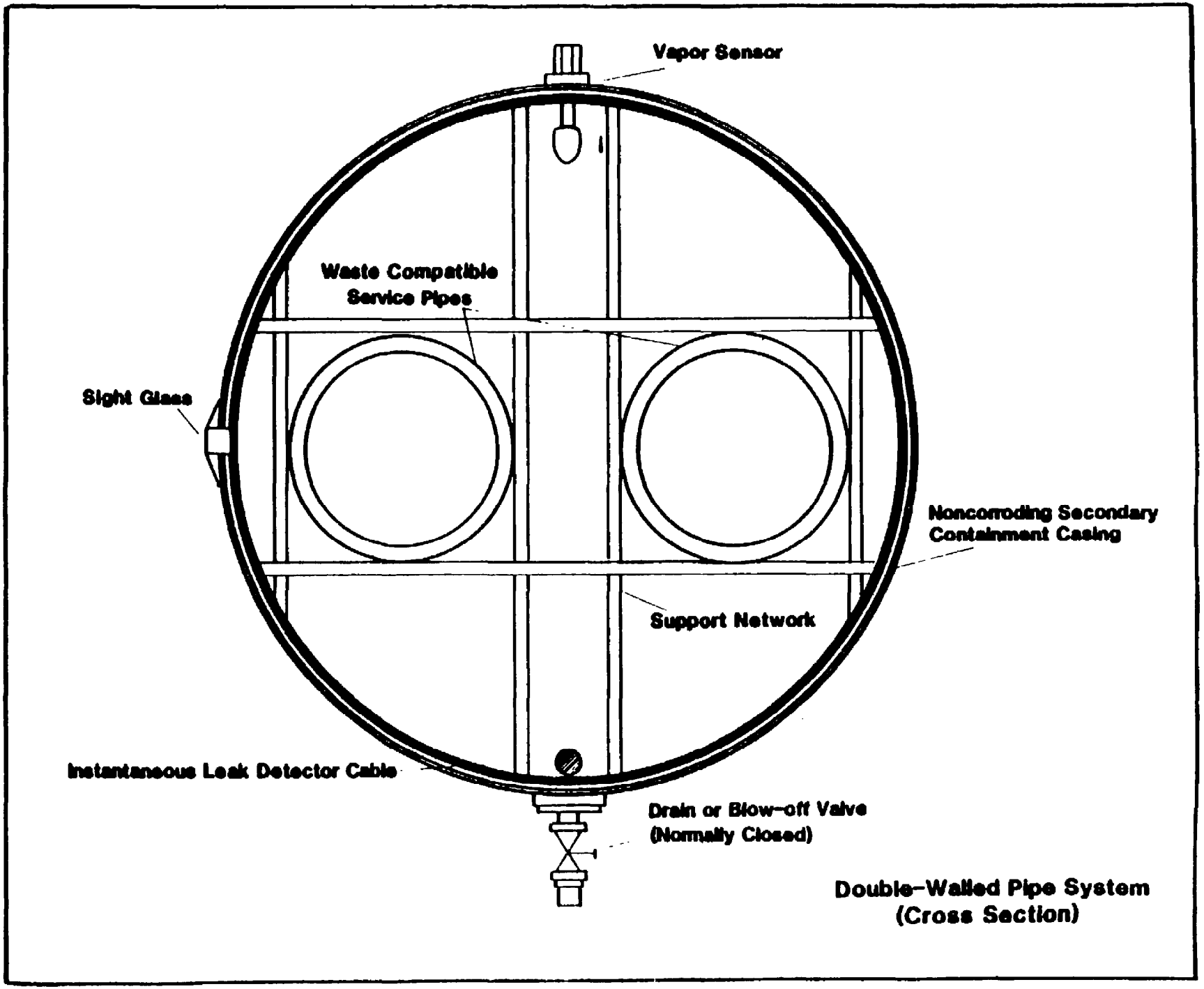

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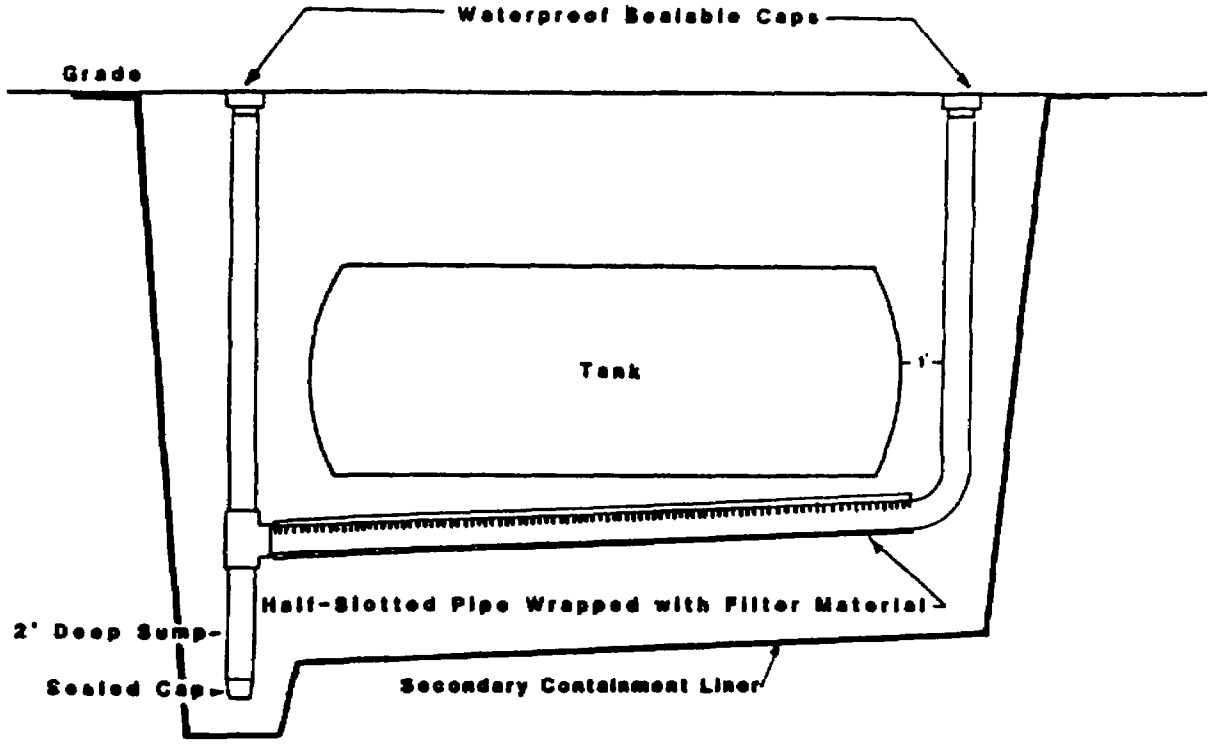
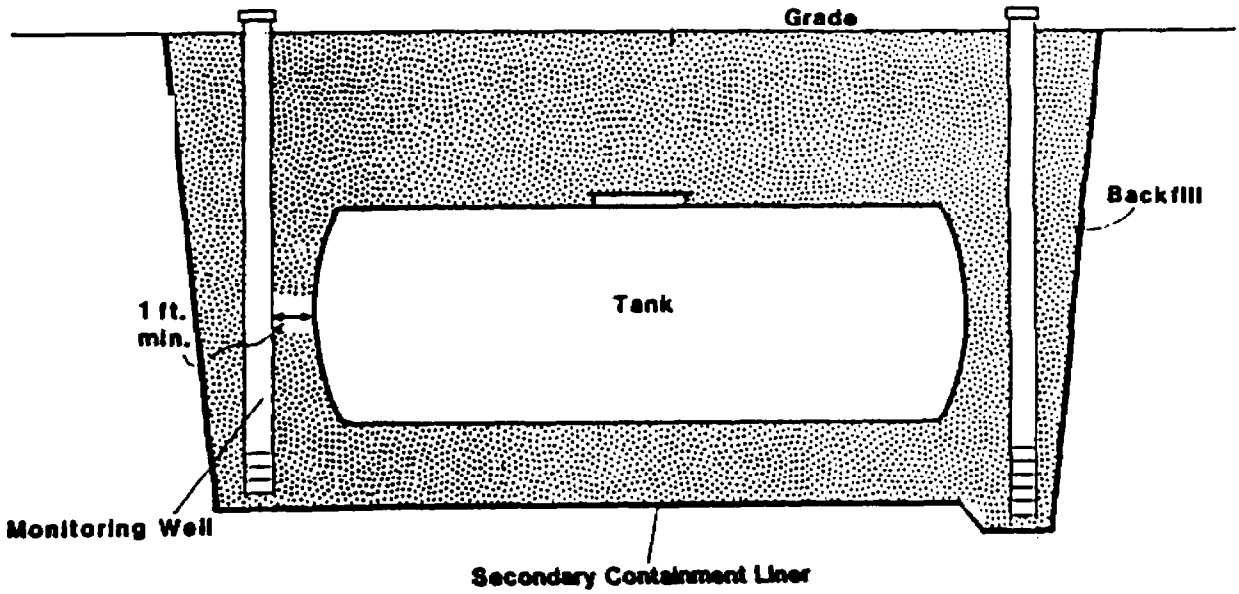
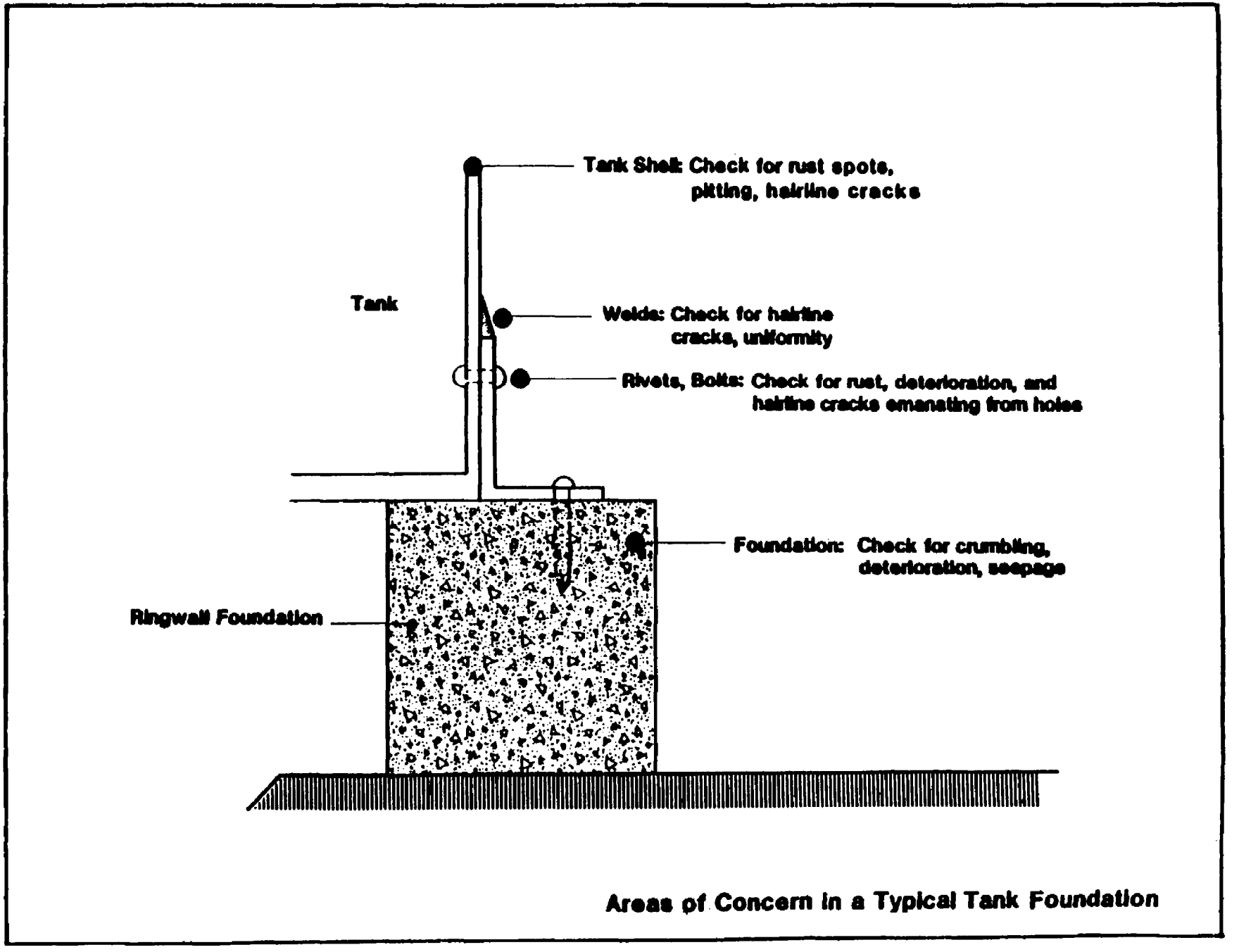


Typical U-Tube Placement



Typical Observation Well Placement



Areas of Concern in a Typical Tank Foundation

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APPENDIX C
GLOSSARY

Tank-Specific Definitions

When used in 40 Part 264, Subpart J (as revised July 14, 1986), the terms in this manual have the following meanings:

"**Aboveground Tank**" (AGT) means a device meeting the definition of "tank" as set forth in Sec. 260.10 that is situated in such a way that the entire surface area of the tank is completely above the plane of the adjacent surrounding surface and the entire surface area of the tank (including the tank bottom) can be visually inspected.

"**Acutely Hazardous Waste**" meets the following criteria, as defined in 40 CFR 261.10:

> It has been found to be fatal to humans in low doses or, in the absence of data on human toxicity, it has been shown in studies to have an oral LD 50 toxicity (rat) of less than 50 milligrams per kilogram, an inhalation LC 50 toxicity (rat) of less than 2 milligrams per liter, or a dermal LD 50 toxicity (rabbit) of less than 200 milligrams per kilogram or is otherwise capable of causing or significantly contributing to an increase in serious irreversible, or incapacitating reversible, illness.

"**Ancillary equipment**" means any device including, but not limited to, such devices as piping, fittings, flanges, valves and pumps, that is used to distribute, meter, or control the flow of hazardous waste from its point of generation to storage or treatment tank(s), between hazardous waste storage and treatment tanks to a point of disposal on-site, or to a point of shipment for disposal off-site.

"**Aquifer**" means a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs.

"**Certification**" means a statement of professional opinion based upon knowledge and belief.

"**Component**" means either the tank or ancillary equipment of a tank system.

"**Corrosion expert**" means a person who, by reason of his knowledge of the physical sciences and the principles of engineering and mathematics, acquired by a professional education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metal piping systems and metal tanks. Such a person must be certified as being qualified by the National Association of Corrosion Engineers (NACE) or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control on buried or submerged metal piping systems and metal tanks.

"**Existing tank system**" or "**existing component**" means a tank system or component that is used for the storage or treatment of hazardous waste and is in operation, or the installation of which has begun, on or prior to the effective date of the regulations (July 14, 1986). Installation will be considered to have commenced if the owner or operator has obtained all federal, state, and local approvals or permits necessary to begin physical construction of the site or installation of the tank system, and if either: (1) a continuous on-site physical construction or installation program has begun; or (2) the owner or operator has entered into contractual obligations--which cannot be cancelled or modified without substantial loss--for physical construction on the site or installation of the tank system scheduled to be completed within a reasonable time.

"**Facility**" means all contiguous land, structures, appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

"**Freeboard**" means the vertical distance between the top of a tank, or surface impoundment dike, and the surface of the waste contained therein.

"**Groundwater**" means water below the land surface in a zone of saturation.

"**Incompatible waste**" means a hazardous waste which is unsuitable for: (1) placement in a particular device or facility because it may cause corrosion or decay of containment materials (e.g., container inner liners or tank walls); or (2) co-mingling with another waste or material under uncontrolled conditions because the co-mingling might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes or gases, or flammable fumes or gases.

"**Inground tank**" (IGT) means a device meeting the definition of "tank" set forth in Sec. 260.10 that has a portion of the tank wall situated to any degree on or within the ground, thereby preventing expeditious visual inspection of the surface area of the tank that is on or in the ground.

"**Installation inspector**" means a person who, by reason of his knowledge of the physical sciences and the principles of engineering, acquired by a professional education and related practical experience, is qualified to supervise the installation of tank systems.

"**Leak-detection system**" means a system capable of detecting either the failure of the primary or secondary containment structure or the presence of hazardous waste or accumulated liquid in the secondary containment structure. Such a system must employ operational controls (e.g., daily visual inspections for releases into the secondary containment system of aboveground tanks) or consist of an interstitial monitoring device designed to detect continuously and automatically the failure of the primary or secondary containment structure or the presence of a release of hazardous waste into the secondary containment structure.

"**New tank system**" or "**new tank component**" means a tank system or component that will be used for the storage or treatment of hazardous waste and for which installation has commenced after January 12, 1987. However, for the purposes of Secs. 264.193(g)(2) and 265.193(g)(2), a new tank system is one for which construction commences after January 12,1987. (See also "existing tank system.")

"**Onground tank**" means a device meeting the definition of "**tank**" in Sec. 260.10 that is situated in such a way that the bottom of the tank is on the same level as the adjacent surrounding surface so that its external tank bottom cannot be visually inspected.

"**Sump**" means any pit or reservoir that meets the definition of tank, and those troughs/trenches connected to it that serve to collect hazardous waste for transport to hazardous waste storage, treatment, or disposal facilities.

"**Tank**" means a stationary device, designed to contain an accumulation of hazardous waste, which is constructed primarily of non-earthen materials (e.g., wood, concrete, steel, plastic) which provide structural support.

"**Tank system**" means a hazardous waste storage or treatment tank and its associated ancillary equipment and containment system.

"**Underground tank**" (UGT) means a device meeting the definition of "**tank**" set forth in Sec. 260.10, whose entire surface area is wholly submerged within the ground (i.e., totally below the surface of and covered by the ground).

"**Unfit-for-use tank system**" means a tank system that has been determined through an integrity assessment or other inspection to be no longer capable of storing or treating hazardous waste without posing a threat of hazardous waste release to the environment.

"**Zone of engineering control**" means an area under the control of the owner or operator that, upon detection of a hazardous waste release, can be readily cleaned up prior to the release of hazardous waste or hazardous constituents to ground water or surface water.

APPENDIX D
REFERENCES

Synopsis of Pertinent References

1. Compatibility of Waste in Hazardous Waste Management Facilities--A Technical Resource Document for Permit Writers, US EPA (November 1982). This manual provides guidance on how to determine the compatibility of hazardous wastes with other wastes and with the various types of structures - tanks, piles, and containers - in which they are stored or treated.

2. Design & Development of a Hazardous Waste Reactivity Testing Protocol, US EPA (October 1984). The test scheme developed for determining waste compatibility includes a field-test kit, a series of flow diagrams, and a manual for using the flow diagrams and test procedures. It also employs a compatibility chart, which classifies wastes by chemical class and/or procedures to classify hazardous waste materials according to their gross chemical composition when little or no prior knowledge is available regarding their components. Chemical composition information is then used to predict which waste materials can safely be mixed before actually performing mix tests.

3. Draft Guidance for Subpart G, Closure and Post-Closure Care Standards and Subpart H, Cost Estimating Requirements, US EPA (January 1987) OSWER Directive #9476-00-5, NTIS PB-87-158-978. This document outlines procedures for TSDF's for complying with regulatory requirements for closure and post-closure care.

4. Lining of Waste Impoundment and Disposal Facilities, by Matrecom Incorporated, for the US EPA (September 1980). Based upon the current state of the art liner technology, this report provides information on performance, selection, and installation of specific liners and cover materials for various disposal situations. It further describes the effects various wastes have on liners; liner service life and failure mechanisms; installation problems; cost information; and tests that are essential for pre-installation and monitoring surveys.

5. Model Permit for Hazardous Waste Treatment, Storage & Disposal Facilities, US EPA (undated draft). Companion to Permit Writer's Guidance Manual for Hazardous Waste Land Treatment, Storage and Disposal Facilities, the model permit provides a standard permit format for facilities that store, treat, or dispose of hazardous waste. The model is divided into modules for various types of permit conditions.

6. Permit Applicant's Guidance Manual for the General Facility Standards, US EPA, SW 968 (October 1983). Guidance for permit applicants that addresses general information requirements of 40 CFR Sec. 270.14(b) (1-12, 19) and the Sec. 264 standards referenced by those requirements for Part B applications.

7. RCRA Inspection Manual, OSWER No. 9938.2A, US EPA (March 1988). This manual has been developed to support federal, state, and local inspection personnel in conducting field inspections of RCRA-regulated facilities to determine facility compliance with RCRA regulations.

8. RCRA Permit Writer's Manual for Ground Water Protection (40 CFR 264 Subpart F), US EPA (October 1983). Provides a comprehensive examination of items covering ground water protection requirements for permit writers to examine when reviewing Part B applications.

9. Recommended Practices for Underground Storage of Petroleum, by Fred C. Hart Associates for the New York State Department of Environmental Conservation (May 1984). This manual provides specific guidance for the underground storage of petroleum and petroleum-derivative liquids. The manual is intended for engineers, inspectors, and owners who are designing or upgraded their underground facilities for leak and spill prevention. Specific guidance includes: (1) design of tanks and piping systems; (2) installation of underground storage tanks; (3) secondary containment; (4) leak detection; (5) overfill protection and transfer spill prevention; (6) tightness testing; (7) storage tank rehabilitation; and (8) closure of underground storage facilities.

10. Technical Resource Document for Obtaining Variances from the Secondary Containment Requirement for Hazardous Waste Tank Systems, Vol. I and II (February 1987), OSW, US EPA NTIS Nos. PB-87-158655, PB-87-158663, OSWER Policy Directive #9483.00-2. This document is prepared to help

owner/operators of hazardous waste tank systems to apply for either a technology-based variance or risk-based variance from secondary containment.

11. Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems, OSWER Policy Directive # 9438.00-01. This document provides a complete review of the regulations promulgated governing hazardous waste storage and treatment tank systems. This document also provides a technical reference concerning the design and installation of tank systems in order to satisfy the regulatory requirements. This document is written for owner/operators to help them comply with EPA regulations for hazardous waste tank systems.

12. Technology for the Storage of Hazardous Liquids--A State-of-the-Art Review, by Fred C. Hart, Associates, for the New York State Department of Environmental Conservation (January 1983). This manual is a compilation of much of the latest information on underground and aboveground storage systems and on state-of-the-art equipment available for storing and handling hazardous liquids in tanks. Included is a discussion on the technology and practices for storage of petroleum and other hazardous liquids which could be accidentally released into the environment. Among the topics covered are: design features; piping systems; spill containment systems; spills and overfill prevention systems; leak and spill monitoring; and testing and inspection for both underground and aboveground tanks.

13. Underground Tank Leak Detection Methods - A State-of-the-Art Review, (1986) RPA/600/2-86/001) by IT Corporation for ORD, US EPA. This report is a state-of-the-art review of available and developing methods for finding small leaks in underground storage tanks used primarily for petroleum fuels. This review describes a total of thirty-six volumetric, non-volumetric, inventory monitoring and leak monitoring methods; provides general engineering comments; and discusses variables which may affect the accuracy of detection methods.

14. Questions and Answers Regarding the July 14, 1986 Hazardous Waste Tank System Regulatory Amendments, (August 1987), US EPA, OSWER Policy Directive #9438.00-3, EPA/530-SW-87-012. This document is intended to provide answers to many of the questions that are likely to arise concerning compliance with the new requirements for storage and treatment of hazardous waste in tank systems.

15. Compilation of Persons Who Design, Test, Inspect, and Install Storage Tank Systems, (February 1988) US EPA/530-SW-88-019. This document provides lists of individuals and companies who: (A) assess existing tank system integrity, (B) assess new tank system design, (C) determine corrosion potential, (D) inspect new tank installations.